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A REMARKABLE COLLISION.

"On Monday afternoon, January 17," says the *Post* of Lindsay, Canada, "the singular sight could be seen on Victoria Avenue of two locomotives piled one on top of the other, and a snow plow underneath crushed out of all resemblance to the useful machine that clears the track. During the afternoon a violent snow storm had prevailed. At times the snow fell in such a cloud as to prevent anything being caught sight of more than ten feet away. During the height of the storm, engine 634, driving snow plow No. 18, passed the junction (Lindsay north), having come south over the Cobo-conk line, under orders. A few minutes before, engine No. 624 left the station with a train of freight cars to haul to the junction. Just above Elgin Street, Driver McIntosh caught sight of the plow and engine, but it was only a few yards away at the time. Driver McIntosh and Fireman Rogers jumped from the engine and landed in a snow bank. Conductor Pym was not so fortunate, for in scrambling out on the tender to make the leap he was a moment too late, and was thrown from the tender to the ground, escaping unhurt. Driver R. Johnston and Fireman Tutton of 634 stuck to their engine. In fact, the first intimation they had of the state of affairs was on seeing engine 624 making desperate efforts to climb up on top of the boiler of 634, accompanied with a fearful clatter and smashing of things generally. A cab behind 634 was uncoupled by the shock and shoved back nearly two hundred yards. The momentum of engine 624, backed by the weight of a long line of freight cars, was terrific. The engine was forced up the plow as if up a short and very steep grade, leaving the front truck and pilot buried in the board work of the plow. The pilot, smoke-box, stack, and upper works of engine 634 were smashed into pieces and thrown about. The tender of 624 followed the engine, and hung suspended by the couplings, with the rear truck resting on the track. It seemed almost incredible that such an enormous weight as that of a locomotive could be pushed up in such a manner and fastened so securely."

Our engraving is from a photograph taken by J. Britton, photographer, after engines were hauled down to the yard to be dismounted.

This accident reminds us of one that occurred in 1874 on the Chicago and Northwestern Railroad, when two engines collided and reared up on end, locking their wheels together, and remained in upright position, presenting a remarkable spectacle. It was illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, No. 40, September 30, 1876.

A REMARKABLE COLLISION AT LINDSAY, CANADA.

Protection of Buildings from Lightning.

The French Minister of Public Instruction recently submitted to the Academie des Sciences an important question concerning the fitting of lightning conductors for public schools and other large buildings. It appears that a departmental commission represented to the minister that it was necessary in a particular case to connect all the iron stairs and other internal metal work of a school building to the lightning conductors, so as to prevent the danger of lightning leaving the outside conductors and striking through walls or roofs at the insulated metal inside. The minister logically concluded that if this was done for one building, it should be done for all similarly circumstanced; and as this action would involve the expenditure of a considerable sum, he asked the opinion of the Academy upon the point.

The committee to whom the question was referred have reported to the effect that it is indispensable for the perfect protection of buildings from lightning that the conductors should be well connected with all important metallic masses inside. The case applies not only to iron in roofs, partitions, or staircases, but also to gas and water pipes, heating apparatus, and similar metallic fittings. It is laid down also that where there are many lightning conductors attached to a building, the nearest of them should be placed in connection with the metallic masses in question. It is understood on the part of the committee that the lightning conductors themselves are always properly "grounded," by being put in perfect connection with the earth by means of a well which is never dry.

This general method of increasing the factor of safety in buildings, in case of lightning stroke, has been advocated in the SCIENTIFIC AMERICAN for the past twenty-five years, and we believe was first publicly suggested in these columns. We have repeatedly shown how faulty, if not useless, is the ordinary lightning rod system, where the lower end of the rod is simply stuck a foot or two into the dry ground; and we have urged, first, that the rod must have a thorough and extensive conducting surface in contact with the earth; second, that all metallic fittings both within and without the building should be connected with the rods, or with special rods leading to the ground terminals. Where there are underground metallic pipes, such as water, gas, or drains, the rods should be connected with them. If there are no such metallic pipes or masses, then long trenches leading away from the building should be dug, deep enough to reach moist ground, pulverized coal should be placed in the bottom of the trenches, and the lower end of the rod extended for a considerable distance in the trench in contact with the coal, which is itself a conductor.

Importance of Furnishing Good Goods to Mexico.

In many lines of goods American manufacturers have a well established trade, says the *Mexico Financier*, referring to its own country, and this satisfactory condition of their business may be attributed to the excellence of the articles sent here, the care taken in packing, and the liberal terms accorded to Mexican buyers. In other lines of goods, especially in those which already are extensively sold here by German, English, and French houses, the American manufacturers, with some exceptions, are foolishly regardless of the elemental rules of sound business. It seems to be their policy to send here imperfect articles, or, when shipments are made of perishable articles, to neglect the same precautions they would take for long routes in their own country. The fact that the Mexican public requires the best grades of goods, and is accustomed to get them from Europe, in all but a few lines, needs to be impressed on American manufacturers.

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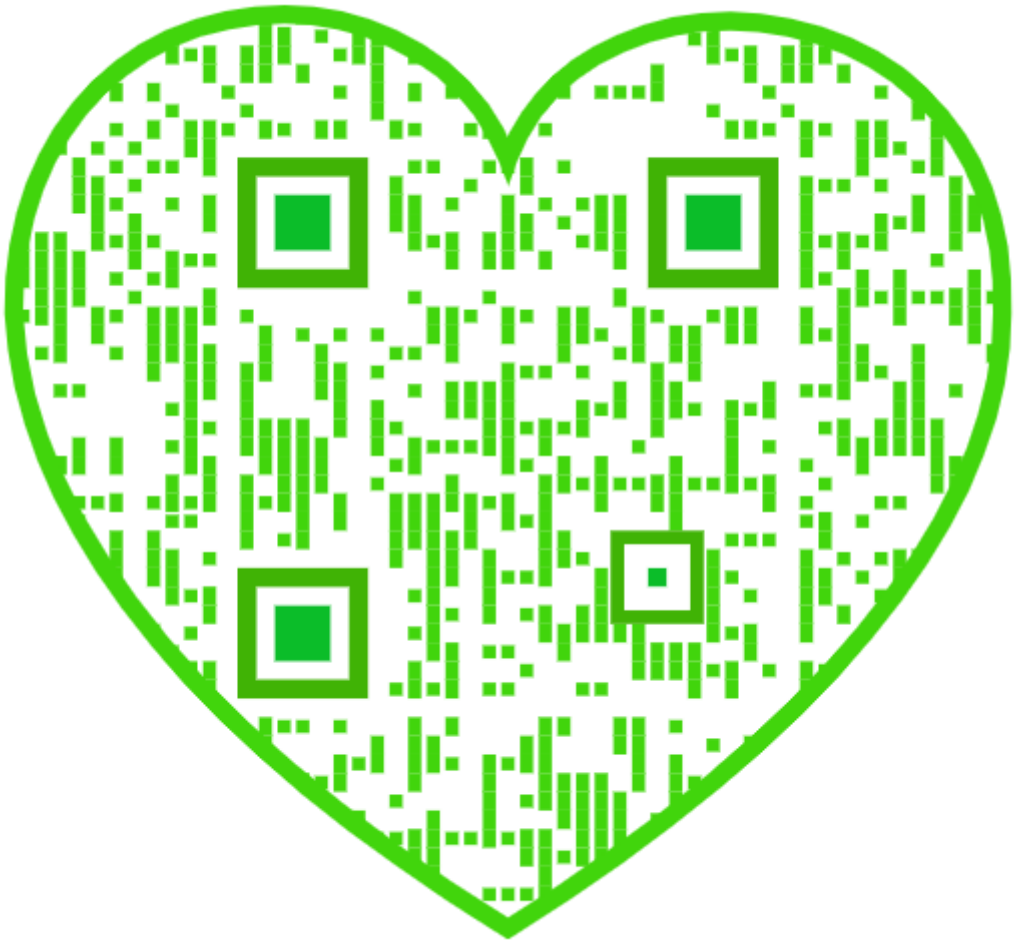

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NEW YORK, SATURDAY, FEBRUARY 19, 1887.

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GREAT WAR SHIPS AND FORTS.

Are armored ships and big guns and forts necessary to an effective defense? The Senate, in favoring a preliminary appropriation of $21,000,000, has virtually said yes. It remains for the House to put in its measure. Outside of Congress, there is quite as distinct difference of opinion in regard to the general proposition among the well informed. Those who do not favor the building of a great armored fleet and costly shore works have recently been joined by Captain John Ericsson, the designer of the famous Monitor.

He makes the point that a port like New York can be successfully defended without them, and following this argument to its conclusion, those opposed to great outlays for ships and forts might logically insist that by Ericsson's admission they were unnecessary.

He says that the problem before us is how to beat off a fleet of modern war ships, whose tactics during bombardment would be that of retreating to the open sea before night.

To successfully accomplish this in the ordinary way, we should have guns capable of piercing twenty inches of armor at ranges varying from six to seven miles. As to stationary torpedoes, such mines may be countermined, and even the fish torpedo, like the Whitehead and the Lay, cannot be effectively served with hostile machine guns in play. After explaining to us the nature and virulence of our disorder, Ericsson, like a skillful physician, comes to our relief with an antidote. As may be guessed, the antidote is the Destroyer type of submarine torpedo server, and those unfamiliar with the man's history may jump to the conclusion that he is anxious for government contracts. Such a conclusion would be as unjust as it is hasty; for, to one who has seen the great maritime powers use his designs as criteria from which to remodel their fleets, who may fairly be said to have revolutionized naval warfare, and whose sands of life are nearly spent, fortunes would not compensate for failure.

He says:

"I have for a series of years studied, under special advantages, the problem of defending the harbor of New York against first-class ironclad ships. I have positive grounds for recommending the adoption of the submarine gun of 16 in. caliber, as applied in the Destroyer. This gun possesses power and capacity to expel projectiles carrying explosive charges weighing 300 lb., hence capable of shattering the hull of a Lepanto or an Inflexible. The vessel carrying the submarine gun, being protected by an impregnable breastwork of inclined solid armor plates two feet thick, backed by six feet of timber, is capable of resisting any ordnance whatever during attack bows on. I deem it important to observe that, like the Destroyer, all vessels carrying the submarine gun, whatever be their size, must be provided with steam turning gear, by means of which they can be directed to any point of the compass without backing or going ahead."

To err is human; the best calculations sometimes fail, and hence nothing which is the product of man's understanding or foresight is altogether reliable and certain. But if a man is to be judged by his works, if probability of success in the future is to be measured by that of the past, then no man is more entitled to a fair and patient hearing than Captain John Ericsson. The mode of attack which he has adopted for his Destroyer, like that of his Monitor, does not rely for success upon favoring conditions of tide and wind and shore line. He goes straight to his mark. Calculating what is the worst the enemy can do against him, what the crushing power of his heaviest blows, he devises an armor shield that will defeat the purpose under the most favorable conditions the enemy can discover. The many experiments made with heavy guns at Spezia, at Cronstadt, at Woolwich, and other points, have been carefully studied by Ericsson.

Those who believe in the efficacy of the fish torpedo principle and in dynamite guns will, no doubt, regret that the inventor dismisses them after so cursory an examination. He says: "Whitehead's torpedo, in itself a useful weapon, is carried by light, frail vessels, incapable of withstanding the fire of the hundreds of quick-firing machine guns carried by an attacking fleet.

"Well protected and pointed by a reliable method, besides being favored by daylight and the smooth water of the bay, these admirable guns could in a few hours destroy a fleet of our torpedo boats. On the other hand, our present forts and guns, assisted, if necessary, by temporary earthworks, mounted with light artillery of any caliber, could quickly dispose of the enemy's torpedo boats intended to protect the ironclad intruders against our small vessels carrying the dreaded submarine gun."

If this is true, and ordinary light artillery can stand off torpedo boat catchers, why could not the fish torpedo boat and the dynamite gun boat be protected by heavy inclined armor, like that of the Destroyer? Both the fish torpedo and the dynamite gun have a far longer range than the Destroyer's submarine gun; and those who have seen the dynamite gun and the submarine gun at work, as the writer has, will incline to the belief that the former is at least quite as reliable, while, at the same time, by no means so complicated. What splendid work the dynamite gun could do afloat with its one mile effective range, if only it could be protected against the assault of heavy guns!

ELECTRO-MOTOR VS. CABLE TRACTION.

Those who have been in upper Eighth Avenue, New York city, recently, may have noticed a car, similar in most respects to the ordinary street car, save that it moves over the rails without the aid of horses or any other visible agents of propulsion. This is the Julien electro-motor, now experimentally at work, brought here last fall by its designer, Mr. Edmond Julien, and who, it is said, has had no little success with it on the European continent, notably in Belgium.

Mr. Julien, like others who preceded him in the development of the electro-motor, discards the system of electrical mains, both surface and aerial, carrying his electrical energy aboard instead of picking it up while *in transitu*.

The accumulators are placed in apertures in the sides of the car, and connected up with the driving wheel apparatus by wire in the ordinary way. They are charged from an electrical generator, working in the car stable, and are ranged in tiers on either side of a siding in the depot. The car is then run in on to this siding, the exhausted accumulators are taken out of it, and those that have been re-enforced thrust into the places left vacant. It is hard to see how this operation could be more conveniently or expeditiously accomplished. It is the custom of the horse car managers to run their cars into the stables at certain intervals; "swinging," the operation is called, and is necessary in order to afford drivers and conductors opportunity to get their meals.

The Julien car, with its accumulators freshly charged, is good for a seven hours' run; indeed, there is sufficient energy aboard to increase this to ten hours, but it has been found inadvisable, for reasons well understood by electricians, wholly to exhaust electric accumulators of this type. The car moves along Eighth Avenue with an ease only disturbed by the irregularities of the track, and so far as speed is concerned, is limited only by the exigencies of transit through a populous thoroughfare. The round trip over the course, a distance of five miles and a half, occupies about three-quarters of an hour; the car being run slow purposely, so as not to interfere with the regular business of the road.

It is stopped and started by a simple arrangement, the same being an electric switch and an ordinary brake combined; the latter pressing against the wheels immediately after the electric current is cut off from the driving wheel apparatus.

The weight of the car when ready for work is thus distributed:

Car	2,570	kilogrammes.
Accumulators	1,120	"
Wheels	560	"

This makes a total weight of 4,250 kilogrammes, which is something less than five tons. A Siemens motor of horizontal type is used, this, under ordinary circumstances, making 1,000 revolutions a minute. There is but one driving axle, which is worked by flexible cables running in slotted pulleys, which get their energy from a shaft connected by belting to the motor engine.

Mr. Julien describes the elements of which his batteries are composed as consisting of 19 plates, 9 positive and 10 negative, insulated by rubber. The positive plates are four millimeters thick, and weigh each 655 grammes. (A millimeter is 0·03937 of an inch, and a gramme 1-24 of an ounce—15½ grains troy.) The active matter counts in this for 165 grammes. The negative plates are three millimeters thick, and weigh 450 grammes, of which 150 grammes is active matter. These elements therefore contain 2,700 kilogrammes (a kilogramme is 2 lb. 3 oz. 4·65 drachms, or 2·206 pounds avoirdupois), say 26 per cent; including the liquid and the recipient, the gross weight per element is 14 kilogrammes. Ebonite boxes are the receptacles of the elements, which are joined in pairs. The elements in each of these batteries are placed in tension, the electrodes of the elements of the batteries being soldered. In selecting railway apparatus, certainty and reliability comes even before economy.

Hence, it is not enough to show that one class of motor is cheaper than another, but as well that it is quite as reliable. The promoters of the Julien type of electro-motor claim that it is cheaper than cable traction, and bring forward a formidable array of figures in support of the assertion. But is it as reliable? This is, of course, a difficult question to answer with anything like certainty, because of the comparatively limited experience had with the electro-motor. On the other hand, cable roads have for some years been in active and continuous operation; in populous districts, too, where the service is exacting, and where apparatus subject to frequent disarrangement, or even occasional mishap of a serious nature, would prove too costly, however cheap it might be had. It is true, however, as the promoters of the Julien system point out, that an accident to a traction cable, or to the en-

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gines that operate it, stops traffic along the whole extent of the road, while an accident to the apparatus of an electro-metor does not in any wise impede or interfere with travel on an electric road, for it may be removed from the tracks until repaired.

M. Julien could scarcely have chosen a better time for exhibiting his motor in New York City, for quite recently the largest, richest, and most enterprising of the surface roads, to wit, the Third Avenue, decided to adopt cable traction, or electrical, or any other which promises to relieve them of their costly and troublesome horse service. If, therefore, he can show that the electro-motor may be made to give as reliable and as economical service as the cable, he will find a ready market, and one capable of being developed almost indefinitely.

THE BELL TELEPHONE BEFORE THE SUPREME COURT.

The hearing in the Supreme Court of the United States of the five appealed telephone suits, which began on January 24, came to an ending on February 8. The Supreme Court then adjourned to March 7. Whatever the result, these suits will always stand pre-eminent in the history of the bar on account of the interests involved, the mass of testimony taken, and the number of decisions obtained from the different courts. The importance of the Bell patent could be no better illustrated than by the original bringing and present defense of these appealed suits. That a company should so energetically defend a patent that has only six years to run is the best comment on its value. The legal expenses of the Bell Company, spent in sustaining the 1876 patent, must be without precedent in the history of patent litigation in this country. Although two patents are cited, the 1876 patent is the one that gives the monopoly of the electric transmission of speech. It contains the famous undulatory current theory, and is the one concerning which the allegations of fraudulent granting have been made. The litigations were devoted to sustaining it.

Two weeks' time of the highest tribunal in the United States have been devoted to the mere hearing of this appeal. Among the counsel for the Bell Company, Messrs. E. N. Dickerson and J. J. Storrow figured most prominently. Senator Edmunds, Messrs. Lysander Hill, Wheeler H. Peckham, and Cansten Brown were among the leading counsel for the five appealing parties.

The decision of the court will now be watched for with great interest. The probabilities normally would be against the patent. Of late years nearly all the attempts to sustain great and oppressive patent monopolies have failed in the Supreme Court. It would seem impossible that the Bell patent could be sustained as fully as it has been in the circuit courts, if it is not pronounced quite invalid.

As now interpreted, it is a patenting of the transmission of speech by electricity. To carry out this interpretation, the hazy theory of the undulatory current has to be accepted as a legally proved fact, and as representing a patentable thing.

The patent is interpreted to grant the monopoly of a natural force. The breadth awarded to its claim compares with that refused to the patent of the telegraphic inventor, Morse. He sought for a similar judgment, but was refused.

The senior counsel for the Bell Company gave a most eloquent closing appeal for his client. His peculiarities of manner, so familiar in the circuit courts, met with a definite rebuke from Justice Harlan. Notwithstanding this, the counsel recovered sufficiently to portray, later on, in his florid style, the pitiable case of his client, whose honor he declared was impugned by those seeking to destroy his patent. Many of the attacks which he assumes as personally made upon Mr. Bell have been really aimed at the work of the Bell Company and its advisers. Mr. Bell is a man of the highest honor. If, as claimed, his patent, in its granting and sustaining, is shadowed by fraud, no implication of wrong doing is charged to Mr. Bell personally.

The establishment of what Mr. Dickerson called the "Bell Telephone Annex" of the department of justice was commented on. By it he said the resources of the United States were devoted to hunting "down this innocent man to death or destruction." The best comment on this is afforded by the futile results of former attempts at a similar end—the death or destruction of his patent. Mr. Bell's success has been such that he should feel pretty well prepared for further conflicts.

The recognition of Mr. Bell by the University of Heidelberg, "within ten miles of Reis' home," in granting him its diploma last year; the recommendation by the Academy of Paris to the French Government, to award him the Volta prize of 50,000 francs, were both eloquently depicted. Mr. Bell is said to come "writhing in agony" to his counsel for protection. He was told to await the action of the Supreme Court as his vindication, and his protests at having to endure so long were most feelingly spoken of. If Mr. Dickerson's description of his client's feelings is correct, then, if the case goes against him, his plight will be a bad one.

Newark, N. J., Mechanically Considered.

A correspondent of *Engineering* describes the excursion of the Society of Mechanical Engineers to Newark, N. J., as follows:

The manufactories of Newark are seldom realized by those who have not visited them, for the city is overshadowed to some extent by its proximity to New York (nine miles). The population at present is 150,000, and it will probably be 250,000 in the next five years. It is most decidedly a manufacturing city, and (what many even of the mechanical engineers do not know) has turned out some of the finest mechanical work ever made, tools of the most delicate and exact nature, which will cut always and accurately 200 threads to the inch. Many of these were afterward examined by the visitors in Mr. Weston's laboratory, and few of them knew they were made but a short half mile distant.

A large quantity of "foreign jewelry" is made in Newark; the delicate filagree work of the Mexicans, the mosaics of the Romans, and the finely colored work of the Etruscans are all made here, and imported to New York city for sale, and fine specimens of the ancient art they are. The writer has a fine pair of Japanese sleeve buttons, and he obtained them at a Newark factory. Beautiful ancient brasses are also made here, which are even better than the originals, and Russia leather is also a product of this great city. The writer is not speaking ironically of anything but the titles, for the work is as well done as possible, and Newark manufacturers are second to none in the world, as we found out during our visit.

The first place seen was that of Hewes & Phillips, engine builders, and there much beautiful machinery was examined, and their thorough system of doing work favorably commented on by their visitors. From there we went to the Armory Hall, and enjoyed a bountiful feast, and the topical query arose then and there, numbered twenty-nine on our list, viz., "Which do you prefer, a feed pump or an injector?" The answer has not cleared the difficulty, but that could not be said of the tables. The keen air of the bay had sharpened every one's appetite, and the food was of a most appetizing character. Hence the tables were cleared and refilled time and again, until all were satisfied, and in that state were taken to the United States laboratory to witness the great inventions made by Mr. Edward Weston, a member of the society, and one of the most distinguished electricians of the day. It is due to his wonderful mind and great ingenuity that the electric light in the United States occupies the position that it does.

The writer has had the pleasure of seeing Mr. Weston's methods of reaching a result, and he is most eminently analytical and differential. He diagnoses an investigation by analysis into all its possible and probable cases, and proceeds to eliminate them one by one until he reaches the true solution. Having reached this, there are no failures, for the practical result which has been patiently worked out is thoroughly reliable. It was just this method which produced "tamadine" for making the filament in the electric light. Mr. Weston wanted to obtain a homogeneous material, and he found it. Then he threw into the process his mechanical and chemical knowledge, and now this material is readily made and the filament constructed by operators who only know the plain manipulation. These works were not long since described in your columns. Hence nothing further need be added here. Suffice it to say, they proved so extremely interesting to the visitors that it was with greatest difficulty they were started from them one hour after the allotted time, and taken to Watts, Campbell & Co.'s works, where they were again treated to a sight of beautiful mechanical work, and shown how to construct a fine and perfectly working engine.

It was again with great difficulty they were persuaded to leave this interesting place for the Clark Spool Thread Works, an enormous building, which, having outgrown one side of the Passaic River, has promptly extended itself to the outer side. There were many ingenious and interesting machines shown to us here, and not the least interesting to some of the younger members, and it must be said to many of the older ones, were the bright-eyed and roguish-looking girls who attended them. When one factory hand can detain three gray-haired veterans in the explanation of a most simple piece of mechanism, what can be expected of the younger members, who are able to produce the plea of ignorance as an excuse for lingering?

At last all were started for Mr. Weston's private laboratory, which is probably the most complete in the world, and has been visited with delight by many engineers from your side of the water. There are really four laboratories under one roof—the physical, the electrical, the mechanical, and the chemical. This building was called into existence by the demands made on this distinguished engineer for private consultation and experiment. No pains or money have been spared in its fitting up, and everything bears witness to the master mind which conceived not alone the general plan, but each particular detail. It seems to the visitor as though every emergency had been provided for, and Mr. Weston's private practice has grown to such proportions as to absorb almost his entire time. Much time could have been spent here with great profit and pleasure, but the boat must leave before dark in order to get through the drawbridges, of which there are four, without delay. The captain was found in a great state of mind, vowing we stood a good chance of remaining on board all night, but his fears were unfounded, and we reached New York city about 7 P.M., after having a fine view of Liberty with the torch and electric lights around the base in full blaze.

The Employment of Salt for the Removal of Snow.

The current volume of the "Minutes of Proceedings of the Institution of Civil Engineers" contains an abstract of a memoir on this subject by Mr. Barabant, which appeared in a recent number of the *Annales des Ponts et Chaussees*. It appears that in 1880 Mr. D'Ussel gave a description of his first attempts to thaw the thin layer of ice in the public streets, produced by the compression of snow by vehicles in time of frost. Since that period, owing to the expenditure of nearly £200,000 in futile attempts to remove the snow in Paris in 1879–80 and 1880–81, the heavy tax has been removed from pounded salt, not suitable for ordinary purposes, enabling salt to be largely used for clearing away snow, a provision of 4,000 tons of salt having been made for this purpose in Paris for the winter of 1885–86. A regular service for the removal of snow, on its first appearance, has been organized in Paris, as it is important to clear away the snow before it has been compressed into ice by the passage of vehicles, when it is far more difficult to remove. As falls of snow rarely occur at Paris with a temperature much below the freezing point, salt may be sprinkled on the snow, producing a liquid, of which the temperature may descend to 5 deg. Fahrenheit without its freezing.

The salt should be scattered on the streets as soon as the snow begins to fall fast. The mixture is effected more thoroughly by the traffic, it does not adhere to the ground, and gradually liquefies, so that at the end of four or five hours the streets may be cleared by the sweeping machine, the caoutchouc rake passed over the footpaths, and the mixture washed to the sewers by the addition of water. This cold mixture does no harm to paved roads, asphalt, and wood pavements; but salt should not be used on macadamized roads, which are disintegrated by the frequent artificial thaws thereby occasioned. This affords another reason for discontinuing macadamized roads in large towns in France, which possess the great disadvantages of being very muddy in rainy weather or during thaws, and of discharging quantities of sand into the sewers.

The employment of salt would probably be very restricted in countries where the temperature often falls below 5 deg.; but everywhere else it furnishes the best means of dealing with snow. It has been suggested that the coldness of the mixture is disagreeable to foot passengers, destructive to boots, and bad for horses' feet; but the latter can be protected by greasing the inside of the hoof, and as the mixture should be removed directly it becomes liquid, the inconvenience, both to men and animals, is very short in duration, and very slight compared with the advantages and economy of the system.

The salt should be scattered in the proportion of about one drachm per square foot for each four-tenths of an inch of thickness of snow fallen, or a larger amount if the temperature is low. Formerly, each centimeter—0·4 in.—depth of snow falling in Paris necessitated an expenditure of over £2,400, whereas now the cost is only about £800, or a saving of two-thirds. Moreover, the use of salt dispenses with sanding the streets, which, on the arrival of a thaw, produced quantities of mud in the streets and deposit in the sewers. Further, if the cessation of interruptions of traffic by means of this process is taken into account, the indirect gain to the people of Paris must be reckoned by millions of francs. Several machines have been devised for the removal of snow, but none of them is as cheap as salt; and the author gives a comparative estimate of the cost of melting snow by steam and by salt, which shows that the method of steam would be much more expensive, besides entailing other disadvantages.

The use of salt will probably not be confined to the clearing of streets in towns, but be extended to all paved roads, to tramways, and to the approaches to railway stations and all large manufactories. Perhaps, even in France at any rate, salt might be used for dealing with snowdrifts in railway cuttings, by spreading it in sufficient quantities and sweeping thin layers successively salted.

On all paved roads over which there is considerable traffic, the use of only half the proportion of salt adopted in Paris would enable a track of 6½ ft. to 10 ft. in width to be dealt with, along which the snow would be prevented from being frozen to the ground, and thus rendering traffic almost impracticable. The small cost of the system, and the advantages to traffic, are sufficient reasons for an early and wide extension of the use of salt for removing snow.

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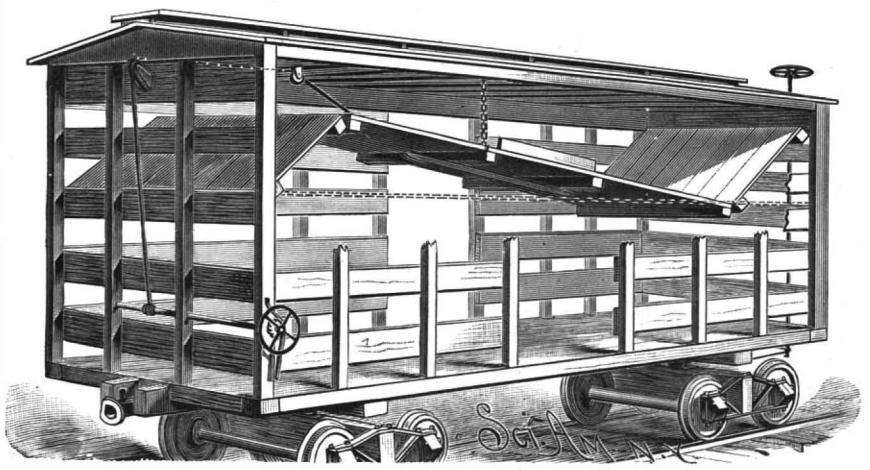
DOUBLE-DECK STOCK CAR.

This car is so designed that it may be quickly and easily changed from a single to a double floored car; the object being to provide a car that may be used either for the transportation of cattle or of sheep, hogs, or other small animals. The car, which may be of the ordinary form, is provided with a movable auxiliary, or upper, floor. To the top of one end of the car is hinged a heavily made flap, or leaf, to which, in turn, there is hinged a platform, to the opposite end of which is hinged a second flap, which is hinged to the end of the car at a point just in line with the surface of the platform when the latter is in its lowered position. The platform normally rests in its lowered position, being then supported by suitably arranged cleats; but when the car is to be cleared for the purpose of transporting cattle, the platform is drawn up until it occupies a position just beneath and parallel with the roof of the car. This movement is brought about through the medium of a chain or rope, one end of which is secured to the end of the platform, as shown at the left in the engraving, while the other end is guided over sheaves, located as shown in the drawing, and secured to a shaft preferably mounted at one end of the car. The shaft is provided with a hand wheel and pawl-and-ratchet attachment. To draw the platform up (it is represented in the engraving about midway between its upper and lower positions), the hand wheel is turned to wind the rope upon the shaft, thus drawing up the platform and its leaves. When the platform is to be lowered, a handle on the pawl is moved so as to release the pawl from the ratchet, when the weight of the platform causes it to drop to its lower position. When the platform is lowered, side flaps hinged to it drop into the spaces between the doors and edges of the platform. The center of the platform is steadied and supported by a chain, as shown.

This invention has been patented by Mr. Louis H. White, of St. Augustine, Florida.

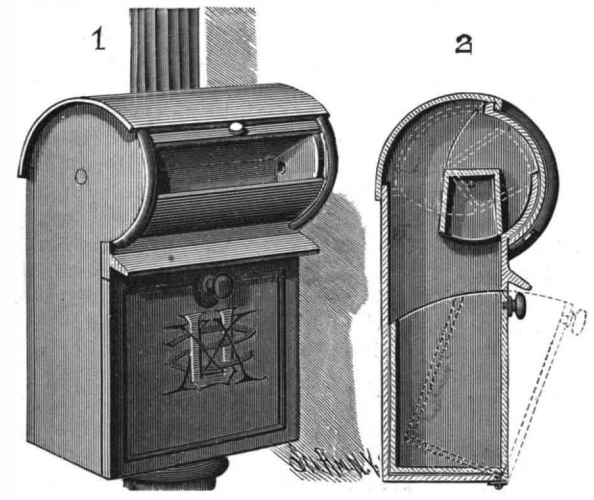


WHITE'S DOUBLE-DECK STOCK CAR.

IMPROVED LETTER BOX.

This letter box is provided with a shifting receiving frame, arranged to deposit the mail in the main receptacle, and constructed so as to close the same when moved to position for receiving the mail. The top of the casing forms a semi-cylindrical dome, having an opening through which the mail matter is placed in the receptacle of the shifting frame, which is pivoted in the dome, and is so overweighted in front of the pivots that it will swing of its own accord to a closed, inverted position for dropping any mail it may contain into the main receptacle, as shown in the sectional view, Fig. 2. Secured to the front edges of the end plates of the shifting frame is a curved plate, provided with a knob, by means of which the frame may be turned so that its mouth will coincide with the opening in the dome, when mail matter may be deposited. When the frame is in this position, its lower back piece, together with a stationary curved plate held at its ends to the main frame, closes the main lower part of the box, so that no mail already in the box can be extracted. Properly arranged flanges on the movable curved plate and across the upper edge of the dome opening, the side edges of which are covered by curved and grooved heads, prevent the entrance of rain and snow. In the lower part of the main frame is a box so hinged that it may be swung outward and downward, to facilitate the emptying of the mail matter directly into the mail collector's bag.

This letter box, the invention of Mr. A. V. B. Bush, of No. 2 Fulton St., New York city, is adapted to receive either large or small mail matter; and when opened for the deposit of mail, the main part of the box is securely closed, and, as the shifting frame automatically closes itself, there is no danger of the box ever being left open.



BUSH'S IMPROVED LETTER BOX.

IMPROVED WAGON STAKE.

The object of the invention here illustrated is to provide a wagon stake formed entirely of metal, and which will be stronger, cheaper, more durable, and easier replaced in case of breaking than any other style of stake. The tapering body of the stake consists of a flat web of iron surrounded by a flange thickened at two or more points along the outer edge, and provided with holes for receiving the bolt or rivet by which an annular clevis is pivoted to the stake. At the bottom, the flange is widened and extended to form a foot, which rests upon the bolster of the wagon. Projecting from the bottom of the foot is a steady pin, and also a bolt provided with a nut for binding the stake to the bolster. A bolt or screw is also inserted in the bolster through a hole in the extended part of the foot. The stake may be made of cast or malleable iron, and the pin and bolt may be formed integrally with the stake, or may be secured by casting the metal around them, or by screwing them into threaded holes in the stake.

This invention has been patented by Messrs. J. H. Conover and D. S. Brink. Further particulars can be had by addressing the former at Springborough, Pa.

Adhere to One Business.

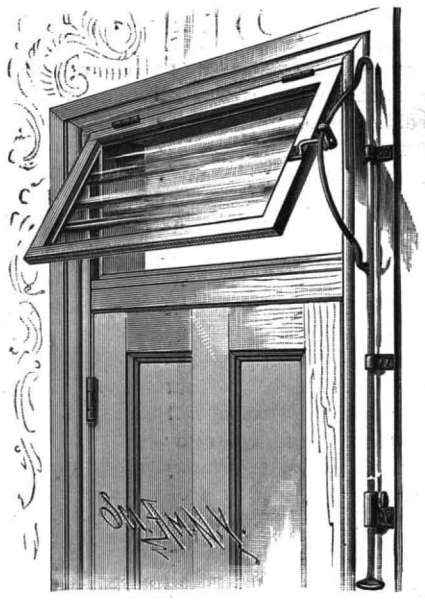
Concentration, says the *Manufacturers' Gazette*, is an important factor in the success of the manufacturer or merchant. The individual who attempts to do everything seldom succeeds in doing anything well. Life is not long enough to exhaust even one branch of science, art, or industry. When one needs anything out of his line of business, it is far better to make the purchase of an experienced and trustworthy neighbor than to undertake to learn another branch of business, with all its cost of experience. The concern which undertakes to make all the money, to get along without making any purchases of others, and to monopolize all the avenues for profit, generally gets left in the race for wealth. The most successful individuals and firms are those which have developed a promising specialty, leaving collateral matters to the attention of their neighbors in trade and industry. The possibilities of any one branch of manufacture grow upon investigation, and develop rapidly under fostering care. The man who gathers all the profits that are in one branch of legitimate industry can well afford to give his brother in trade a chance as well.

THE *Republican* wishes to say a word of disinterested praise for one of the best papers published in this country. We allude to the SCIENTIFIC AMERICAN, published by Munn & Co., New York city. For three dollars a year it furnishes a greater amount of solid reading than is to be found in any other journal on the globe. Its departments of science, mechanics, natural history, and pure literature are unrivaled. Its illustrations present models of excellence in the art of picture making. Every family in the land should take the SCIENTIFIC AMERICAN.—*Hendricks County Republican, Danville, Ind.*

THE fastest ocean passenger steamer afloat is believed to be the Cunard liner Etruria, plying between New York and Liverpool. On her westward voyage, October, 1885, she steamed 481 nautical, or 557 statute, miles in 24 hours, being at the rate of over 23 miles per hour.

IMPROVED TRANSOM LIFTER.

The transom is hinged to the door casing by the upper end of its frame, and carries, on one side, a bracket, in the outer forked end of which is held a grooved pulley, over which passes a curved arm formed on the upper end of a lifting rod sliding vertically in bearings and provided at its lower end with a handle.



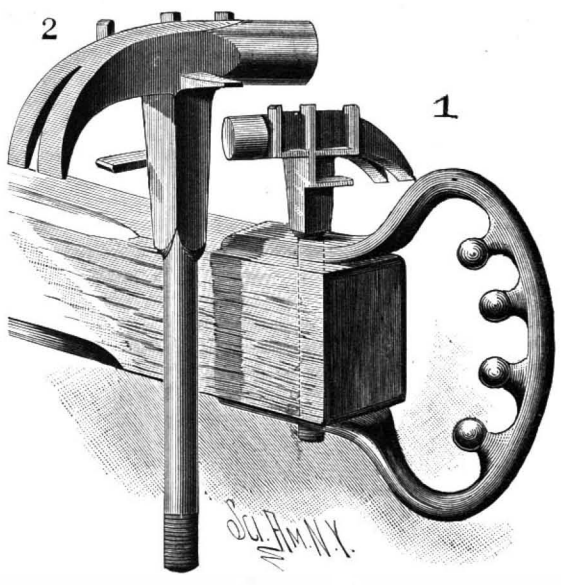
WALKER'S IMPROVED TRANSOM LIFTER.

When closed, the transom can be opened by moving the rod upward, when the curved arm will act on the pulley and its bracket and swing the transom open. The transom can be held in this position by screwing a set screw in the lower bearing against the rod. The set screw also serves to lock the transom in a closed position. The roller prevents jarring, and imparts an easy motion to the transom. The forked end, being attached by the bolt of the roller to the arm, can be swung downwardly, so as to engage the curved arm from the inner side, thus permitting the hinging of the transom at its lower instead of its upper edge.

This invention has been patented by Mr. Leander T. Walker, of South Pueblo, Colorado.

COMBINATION TOOL.

This simple and inexpensive device is adapted for use as a clevis fastening or for holding double trees or neck yokes to the tongues of vehicles. It may also be used as a hammer, wrench, and screw driver, thus facilitating the keeping of agricultural implements in running order. The tool is preferably made of cast steel or iron. Upon one side of the hammer head are wrench sockets (Fig. 1), adapted to receive nuts of different sizes, while from the other side projects a screw driver bit, as shown in Fig. 2. The shank or handle portion is made round, to allow it to be passed through the top and bottom end parts of a draught clevis, which is thereby held to the end of a plow stock, as represented in Fig. 1. The extremity of the shank is threaded to fit a threaded hole in the lower part of the clevis. As the sides of the wrench sockets project beyond the outer face of the head and at the side of the shank, a good hold is obtained upon the nuts, and there is ample room left for the fingers to pass around the handle at the side next to the sockets.



OGLETREE'S COMBINATION TOOL.

It is evident that this tool, which is the invention of Mr. John W. Ogletree, of Powder Springs, Ga., while capable of good service in holding the clevis to the plow or other implement, is always conveniently at hand for instant use when required. When used for holding double trees or neck yokes to vehicle tongues, the screw threads on the shank may be dispensed with.

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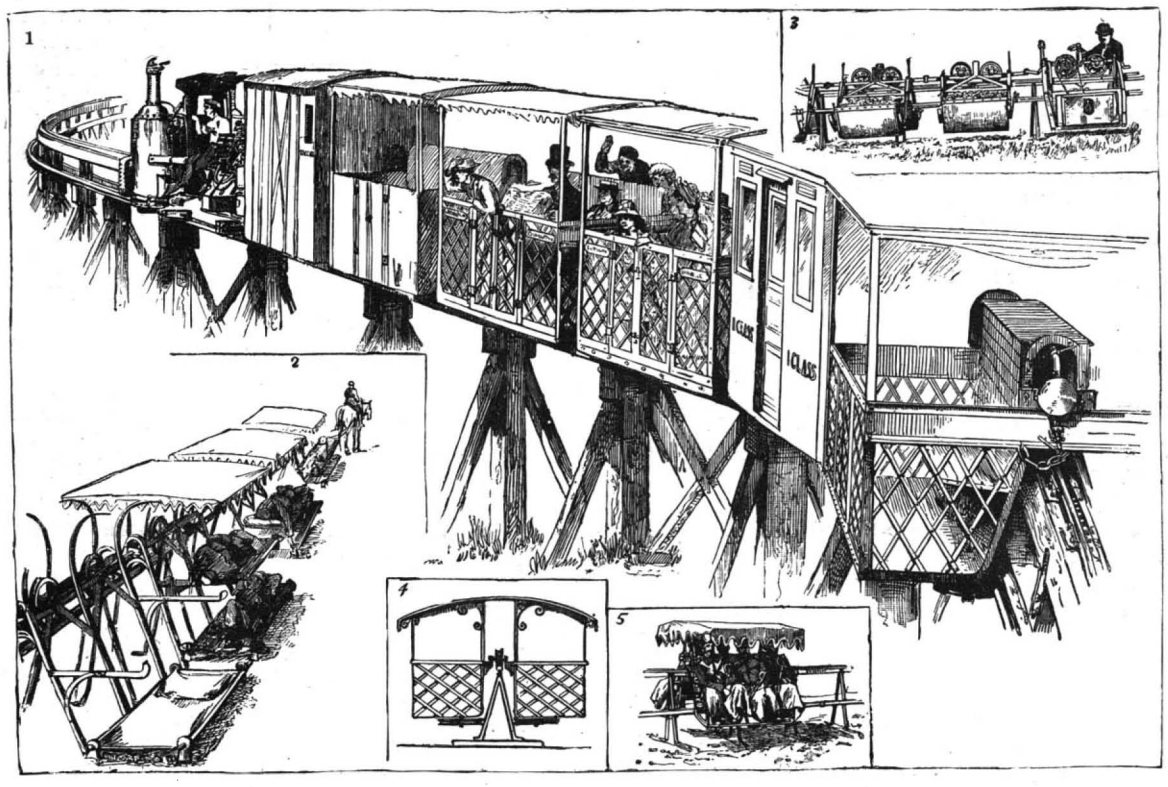
THE LARTIGUE RAILWAY.

The Lartigue railway system is that of a series of cars drawn by horse power or a specially constructed locomotive, running on a single rail elevated a few feet from the ground. The system has been in use since 1883 in several parts of Europe and Africa, and a model line has recently been shown in action near Victoria Street, Westminster. The main features of the system, which is applicable to military, agricultural, or manufacturing lines, are as follows:

The line, which is exceedingly portable, is composed of one rail, of the shape of a flat bar, extremely rigid when subjected to vertical pressure, but easily bent horizontally. This rail is supported above the ground by A-shaped trestles, or frames, made of angle or some very stiff section of iron. The upper extremity of these trestles is bolted to the rail, and the lower extremity rests on the ground, being supported by a bed plate or sleeper, to which the frame is firmly secured. The sleepers may be of different sizes and shapes, and may further be secured in their places when required by long pegs driven into the ground through holes drilled near the extremity of the sleepers, thus preventing the line from shifting. If a river has to be crossed, some light piers can be made, or two wire cables may be stretched across to receive the trestles of the line; while if a ravine has to be traversed, the line can either be carried directly over the gap, or taken down the gorge by means of a zigzag length, which can be connected by curves of as small a radius as ten feet. Moreover, it is possible to use gradients as steep as 1 in 17. On passenger lines, guards to prevent the swinging of the cars, and points, sidings, signal, etc., have been introduced, and everything has been constructed with a special eye to simplicity.

The cars are fitted with two grooved wheels, which run on the rails, but are fashioned according to the purpose for which they are intended. The passenger carriages, as well as the locomotives, are fitted with horizontal grooved wheels, which run on side guide lines, attached to the trestles by the side of the main line, thus imparting steadiness. As our sketches show, it has been tried in Russia both for the transport of troops and of military invalids; in the Pyrenees it is used for carrying ore; while its facilities for passenger traffic were tested at the short line at Westminster. It has been shown at various European exhibitions, and is in use at Algeria and Tunis for carrying esparto grass. Indeed, it was while seeking to solve the problem of carrying the grass from the plains to the main lines of communication that the idea of the single line railway first occurred to the inventor, M. Lartigue, the appearance of a caravan of camels in the distance laden with bags on each side of their humps furnishing the starting point. The advantages claimed for the line are its extreme simplicity and portability. Unevenness of the ground can be balanced by different lengths of trestles, while the motive power can be either electricity, horse traction, or steam. The inventors state that during a trial in Russia, 6 ft. 6 in. were laid down in six minutes by six men, so that a mile could be completed by thirty men in eight hours. In this instance the line was raised 3 ft. 3 in. above the ground.—*London Graphic.*



1 Train of the Lartigue Railway at Tothill Fields, Westminster, ascending a Viaduct on an Incline of 1 in 10. 2. Train for the Transport of Wounded Soldiers, at the Russian Guards' Camp, near St. Petersburg. 3. Electrical Train at the Mines of Ria, in the French Pyrenees, carrying Copper Ore. 4. Section of Railway and Third-Class Open Passenger Carriage. 5. View of Carriage for the Transport of Troops, at the Russian Guards' Camp, near St. Petersburg.

THE LARTIGUE ELEVATED SINGLE RAIL RAILWAY.

THE ALVA—VANDERBILT'S NEW YACHT.

The Harlan & Hollingsworth Company has lately finished for Mr. William K. Vanderbilt the steel yacht Alva, the finest pleasure ship afloat, at a cost, it is said, of about one million dollars. The vessel is commanded by Capt. Henry Morrison, who for many years has acted so faithfully in the service of the American Line between Philadelphia and Liverpool.

The principal dimensions are as follows:

	Feet.	In.
Length over all	285	
Length from stem to post	256	
Length on load line	252	
Extreme beam	32	6
Depth moulded	21	3
Extreme draught	17	
Diameter propelling wheel	13	6

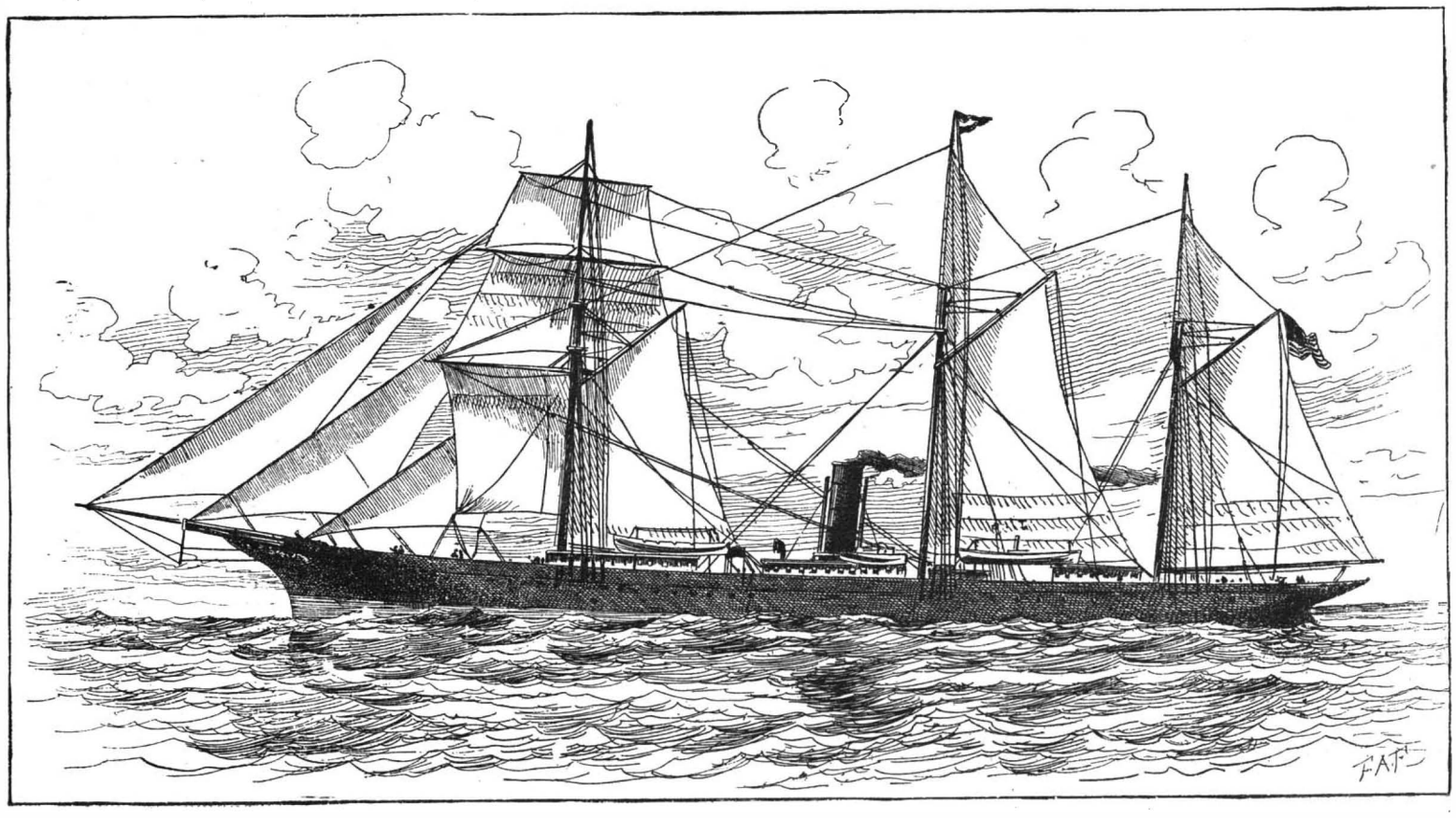
Measurement, in tons O. M., 1,311.

The keel is of bar type, 12 by 2½. The frames are of 4 by 8 by ⅜ angles. Unusually heavy metal, 36 inches deep and 7-16 thick, is used in the floor plates. The midship scantlings are as heavy as if made of ordinary iron, but at the ends of the vessel the sizes have been reduced, and so, with no loss of strength, considerable saving in weight has been effected. The outside plates are five-eighths of an inch in thickness and are flush to three feet below the load water line. Thence to "garboard" she is rated "in and out." The decks are plated to the beams and cross braced diagonally to resist the lateral strains. The wood decking of white pine is laid on top of this. All the deck houses are of steel plate, built into the deck, covered with teak-wood worked in panels. The bulwark stanchions, plank sheers, coamings, skylights, and all other wooden fittings on the upper deck are also of heavy teak.

The Alva has three masts, with yards on the foremast. When leisurely cruising, she will make a large spread of canvas, which will enable her to economize on coal during a long passage. All the work of construction has been done in the shops of the Harlan & Hollingsworth Company. The engine is of the compound surface condensing type, with three cylinders and three cranks, and is of similar make to those which have proved so successful in the Cunard steamers Etruria and Aurania. The cylinders are set in a fore and aft line, are of 32 and 45 inches diameter, with 42 inches stroke.

The Alva's steel shell boilers, of the Scotch type, have nearly 5,000 square feet of heating surface, and will supply steam at a working pressure of 100 pounds to the square inch. They are only 10 feet long, the diameter being 17 feet. It is stated at the yard that, as far as diameter is concerned, these are the largest boilers ever constructed in this country, or even in England.

The bed plate of the machinery weighs 16,990 pounds. The magnificent steel shaft, which is incased in brass, is some 10 inches in diameter. The propelling wheel furnishes an exception to the statement that all of the machinery is of American make. It is of manganese bronze, and was cast in Glasgow, Scotland. It measures 13 feet in diameter, weighs 9,632 pounds, and paid Uncle Sam $1,100 in duties when it came through the Custom House. The coal bunkers of the Alva, which are in the boiler compartment, will carry 300 tons of coal. That the yacht will be equipped with all the latest and most approved appurtenances goes without saying. She will have a steam windlass and steam steering gear that can be operated from the midship bridge. There will be electric lights, bells, speaking



THE ALVA, THE NEW MILLION DOLLAR PLEASURE YACHT.

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tubes, and telephones throughout the ship. Supplementary engines and boilers will be supplied to run the fire engine pumps, the electric dynamo and ice-making machines, and various other apparatus.

The internal arrangements of the Alva are as labyrinthian as those of a palatial hotel. In fact, she is literally a floating hotel, designed for the comfort and luxury of a few select guests. The best hostelry in the land can furnish nothing that will not be found upon this pleasure ship, and few private palaces will surpass her commodious accommodations and material luxuries. In many of the new steam yachts the crew occupy the after part of the ship and the owner and his guests the forward part. In this instance a compromise plan is adopted. The seamen live in the bow of the craft. The owner occupies the space from the forward compartments to the engine rooms, and also several apartments abaft of the machinery, while the captain and his executive officers, the engineers, the chief and the stewards live in the rear compartment. The Alva is expected to have a high speed rate—probably 23 miles or more per hour.

The Hon. William Gurley.

By the recent death of Mr. Gurley, at the age of 66 years, the city of Troy, N. Y., loses one of its most estimable, enterprising, and useful citizens. He was born and always resided in Troy, was prominently identified with its business and social interests for most of his life, was a member of its city government in various positions, and a representative in the State Legislature. He was the senior member of the firm of W. & L. E. Gurley, manufacturers of civil engineers' and surveyors' instruments, was an officer of several financial institutions, and president of the Troy Female Seminary, which he successfully brought through very serious difficulties, and his work for which he was accustomed to look upon as the most satisfactory achievement of his life. Besides the important public positions alluded to, his private life was filled with acts of the most unselfish and kindly nature. His counsel was largely sought and freely given to all.

His Christian character and example in all the relations of his active and busy life were such as to make him a model to the young men of his time.

He had a most ingenious and practical mind, and made many important improvements in the instruments of the engineer, some of which were protected by valuable patents.

His death is really a public loss, and will be a source of sincere grief to the many who knew him in various parts of our land.

Mr. Gurley was graduated from the Rensselaer Polytechnic Institute in 1839, and was at the time of his death its acting president. He was always prominent in religious and charitable work, and in the promotion of what was best and purest in the life around him.

IMPROVED TENT.

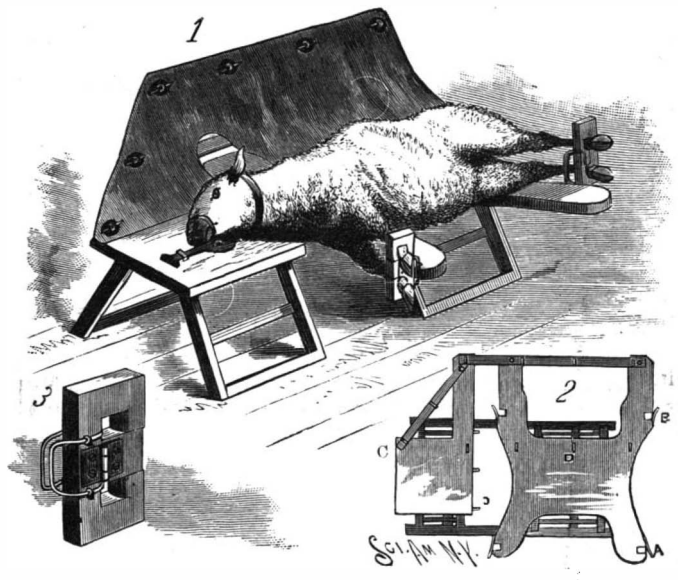
The accompanying engraving illustrates a tent, which is the invention of Mr. Merritt P. McKoon, of El Cajon, San Diego Co., California. As the doorway is placed at the center of one side, the trunks or cots can be placed crosswise of the tent, and near the ends and end poles, thereby economizing room in the center of the tent, where it is most desired. This middle room can be occupied by table, chest, chairs, etc. The half-diamond shaped ends form valuable "stowaway" places, or they can be curtained to form separate apartments when necessary. The center or point seam on each end is rope bound and brass linked over end pole iron spikes at the top of the tent, while the lower end of this rope is left loose for about 20 inches

THE CAMPER'S FAVORITE TENT.

beyond the tent, to becket over tent pin tightly or loosely at will, as dry or wet weather requires. This anchors the tent firmly and solidly, and insures its standing during the most severe gale. The angular roofing or awning over the doorway is of great value; as either one or both of the door flaps can be attached to the sides of the awning at pleasure, so as to obstruct the entrance of sun, rain, or wind when desired, a most agreeable shelter is provided. The tent presents a neat and most attractive appearance, and is as well adapted for lawn or sea shore use as for actual hard camping service.

IMPROVED SHEEP SHEARING TABLE.

The sheep shearing table shown in the accompanying engraving consists of two parts, a main and auxiliary table, the former (A B in the plan view, Figure 2) supporting the body of the sheep, while the latter, C, supports its head. The front corners, A, of the main table are formed with arms, each of which has a hook adapted to hold a stock, which secures the



PHELPS' SHEEP SHEARING TABLE.

legs of the sheep, and the tables are so arranged, in relation to each other, that a space is formed between their adjacent edges through which the front legs of the sheep swing when he is turned from one side to the other in shearing. Thus he is turned on his belly instead of on his back. Attached to the back arms of the main table are other hooks, B, which catch the bails of stocks (shown detached and enlarged in Figure 3) for holding the sheep when turned upon the side opposite to that shown in Figure 1. The stock is formed with an edge opening and with side communicating openings to receive the ankles of the sheep, and a hinged block is arranged to spread the limbs of the sheep into the side openings and also to close the edge opening, so that when the limbs are placed in the stock and the block closed into its opening they will be securely held. The sheep's head is held to the auxiliary table by a strap that buckles around his neck or horns, and is attached to a block provided with a ring to go over his nose. The block is held to the table in loose bearings, which permit it to turn axially so as to give considerable freedom and a degree of comfort to the sheep while confined for shearing. Upon raised fenders attached to the rear edge of the main table, and extending to the outer corner of the auxiliary table, is secured the outer edge of an apron, whose inner edge is secured to the tables by suitable fastening devices. The apron is thus held in an inclined position to receive the wool as it is clipped from the sheep, and a space is cut in it to correspond with the space between the tables, so that it will not interfere with the turning of the sheep, and this space is filled when tying the fleece by raising a second smaller apron provided for the purpose.

This table furnishes an absolute fastening for the legs and head, which can be easily and quickly applied by one person, and a clean, smooth surface on which to fold and tie the wool. The sheep is held in an easy position, in which it does not suffer nor struggle. The sheep can be instantly turned, without lifting and breaking the fleece or scattering the wool, and the fleece when wholly removed is ready for tying for market, with the clean side out.

This invention has been patented by C. B. & J. B. Phelps, of Northville, Cumberland County, Tennessee.

The Work of the Patent Office.

The annual report of the Commissioner of Patents was laid before Congress on February 5. The report calls attention to the utter inadequacy of room and facilities for conducting business in the present office. The Commissioner believes the salary list of the office should be completely revised, which, he thinks, would result in great good, and in no aggregate increase of the total.

The total number of applications filed during the last year, requiring investigation and action, was 41,442, and the number of patents isued was 23,915 The total receipts were $1,154,551, and the expenditures $992,503, leaving a balance of receipts over expenditures of $162,048. The amount to the credit of the patent fund in the Treasury was $3,107,453.—*N. Y. Sun.*

Horrors from Car Stoves.

A fearful railway accident took place at Woodstock Bridge, on the 5th inst., on the Vermont Central Railway. The rear part of an express train, going north at thirty miles an hour, became separated from the front part. The accident took place just at the entrance to the bridge over the White River. Four passenger cars plunged fifty feet down to the margin of the icy stream. A few persons escaped. The wreck was soon on fire from the car stoves; no water was at hand; and the imprisoned passengers, some thirty-five or more in number, were burned alive. This was but a repetition of horrors that have attended other accidents in this country for years past. It is high time that fireproof materials, instead of dry wood, were used in car construction, and that some new mode of heating railway cars was invented.

In this city the five hundred daily trains of our steam elevated railways are comfortably warmed by steam taken from the locomotives. No stoves are used. About a million passengers are daily transported. But this system, although good for local or fixed service, cannot be easily adapted to the varying exigencies of general railway travel, for reasons staten by Mr. Depew, President of the New York Central Railroad. In a recent interview with a reporter of the New York *Tribune*, Mr. Depew said:

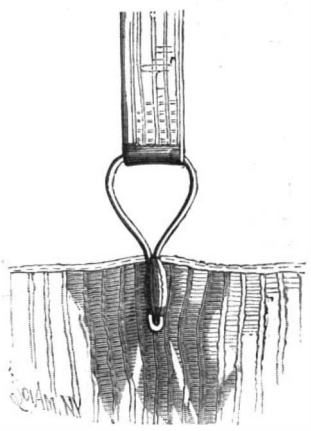
"We make up trains here at Forty-second street, and before the train goes out of the station the engine may be blocks off. It is not always possible to have an engine attached to a waiting car or a train simply to give heat. Another objection to steam is that after a train has left New York, for example, it will pick up additional cars at Poughkeepsie, Albany, Utica, Syracuse, and so on. These cars have been waiting in these stations in advance of the coming of the train, to accommodate passengers and save time. Often they are sleepers, in which persons have gone to bed early. They must be kept warm, and how is that warmth to be had from an engine drawing a train miles away? It has been proposed to have a special boiler attached to the baggage car, with a special attendant. This would give heat to the complete train, but I don't know that the plan has ever been put into any kind of successful operation. What must be devised is a source of heat for each car, without the use of fire."

A Serious Oversight.

A correspondent writes from Cairns, Queensland, to the *Ironmonger* as follows: "England ought to make herself better acquainted with colonial wants, otherwise she will lose a great part of her colonial trade. America is pushing her hard in several lines, such as tools, agricultural implements, and rice machinery. A six horse power machine made in the United States of America can be bought for $900. It is not perfect, for it breaks the rice too much. Let England step forward and make a perfect one, and get the trade, for there will be a great demand for rice machinery in Queensland. Our vehicles are nearly all built in the United States of America, sugar machinery from France, and steel rails from Germany. England cannot hold her own in saddlery; very few will buy an English saddle. You at home by your actions seem to think you know our requirements better than we do ourselves, but when you lose the trade you will not find it an easy matter to get it back again, and you will lose it if you do not alter your ways. It would pay your manufacturers to send out some intelligent persons to see what the colonials require."

GARMENT AND HOSE SUPPORTER.

The accompanying engraving clearly shows the construction of this simple and useful article, which has been patented by A. P. Rindskopf. The middle portion of the wire forming the supporter is bent upon itself so as to make a spring clasp, above which each section of the wire is curved outward and then inward, and the ends are hooked. The supporter is attached to the elastic fabric by means of the hooked ends. A portion of the garment to be supported is then passed through the central curved portion and pulled down within the clamp, which will firmly hold it. There is no danger of the garment being torn, even when of a delicate nature. The supporter is made of the best quality steel spring wire, heavily silver plated.



This device is manufactured by the Brooklyn Shield Co., 67 Sumner Avenue, Brooklyn, N. Y.

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Correspondence.

Taking Cold—A War Experience.

To the Editor of the Scientific American:

Your correspondent Van Bibber's army experience with "Taking Cold" was very much my own. I served with the 13th N. C. Regiment, and though considered a quite delicate young man, I went through with the rest much hardship and exposure. The severest cold I had in the war was when my company was "eating its wheat bread," in the winter of 1861, at Todd's Point, Va., where we had close, comfortable cabins and large roaring fires. There was too much comfort. I had suffered for years from severe attacks of tonsilitis and ulcerated sore throat, that every year confined me to bed for weeks. Yet as a private in infantry fifteen months, and an officer in line the rest of the war, doing hard service, marching through snow, sleet, rain, mud, often sleeping in mud and water, and occasionally waking in the morning covered with snow, I had but *one* attack the whole war, and that was in November, 1863, when we left newly built winter quarters near Orange C. H., Va. (the close, comfortable cabins again!) to go after Meade at Vadairsville. It was a cool night, we were on line of battle, ordered to charge the enemy at early dawn, and hence were allowed little or no fire. My servant had my overcoat and blanket, and was afraid to come to me on line, and I sat all the night over a few coals, green, smoking pine, my throat much swollen, and with a fever. In the morning Meade was gone. My throat was well in two days, I did not quit duty, and I have had but one attack of tonsilitis since, and that was soon after the war.

P. S.—While fully up with the great damage of an intemperate use of tobacco to the nervous system, I always felt more comfortable, and, somehow, as better proof against "taking cold," if in the cold and wet in the trenches, or roughing it on the open plains, I had the quid in my mouth. But it is a nerve destroyer. I am satisfied of that. T. C. EVANS.

Reidsville, N. C., February 2, 1887.

The Boiler Explosion.

To the Editor of the Scientific American:

Seeing the article in your paper of January 1, on "Remarkable Boiler Explosion," by Mark Bacuitt, also in your issue of January 22 by W. P. Woodward, I venture to make a few remarks, which I think, if carefully considered by practical men, will throw a little light on the mystery of boiler explosions.

Mr. Ames, the master mechanic, claims to see no reason for explosion, beyond the fact that the cock in the steam gauge pipe was partially turned off.

FIRST QUESTION.—What was the cock turned off for? ANSWER.—When the spring in a gauge gets weak, or sometimes when the parts are worn, or sometimes in an improperly constructed gauge, the hand of the gauge will vibrate when the locomotive is in motion; to remedy this, the cock in the gauge pipe is turned off until the hand stops vibrating.

SECOND QUESTION.—About how large is the hole left for steam to pass through the cock? ANSWER.—Gauges vary; sometimes, the cock has to be almost closed before the hand stops vibrating.

THIRD QUESTION.—Was this cock put in for this purpose? ANSWER.—No, it was intended to turn off the steam, so that the gauge might be taken off and repaired while there was steam in the boiler.

FOURTH QUESTION.—Is it advisable to turn off the steam from the gauge in any way? ANSWER.—No, repair or renew the gauge.

FIFTH QUESTION.—Is a gauge pipe more liable to plug up by being tested by cold water pressure than by steam? ANSWER.—Yes, especially after extensive repairs on inside of boiler, more or less light substance will be left on the inside of the boiler, which will float on top of the water, find its way to the highest places, one of which is the steam gauge pipe; being too large to pass through the almost closed cock, stick and swell. W. S. FOSTER.

Farnham, P. Q., January 23, 1887.

How Cut Glass is Made.

To the Editor of the Scientific American:

Referring to question 9, J. S. B. (who asks how cut glass is made), in issue of January 22, 1887, page 59, cut glass table ware is not common pressed glass cut over, etc.

In making cut glass, the articles are always blown, not pressed. Goblets, wineglasses, fingerbowls, etc., are made "off hand," that is, they are blown and shaped by hand, the only tools used being a blowpipe and the gaffer's tool. Oval and irregular shaped articles are blown into proper moulds having smooth surfaces, the moulds serving merely to give the shape, and not to impress any pattern. All articles leave the glass maker's hands with a smooth surface, and in this state they are called "blanks." The pattern or design is cut out of the smooth surface with iron wheels adapted to the work. Every line is then "smoothed" on stone wheels, and finally buffed and polished with crocus and rouge on leather and linen wheels. The essential difference in cost and appearance between cut and other varieties of table ware is that in the former the pattern or design is entirely cut out of the solid mass of the glass.

A pressed article, though it were smoothed and polished over, would not be properly called cut glass, nor would it look at all like a genuine cut piece. I will briefly give the reasons for its inferior appearance. In the first place, the glass always shows a "chill" where it was in contact with the iron of the mould.

This "chill" can be taken off the outside surface of any article by subsequently heating the surface to very nearly the melting point, but it cannot be removed from the inner surface of a goblet, for instance. This is one reason why a goblet first pressed and then polished over would not have the brilliancy of a cut goblet. In the second place, the pressure brought to bear on the soft glass when it is pressed greatly affects the refraction of light in the finished article. When the goods are sold as pressed ware, the refraction is again partly restored by reheating the surface, as before mentioned, after the pressure is removed, such reheating serving to take off the chill as well as to swell a thin skin of the glass into a state in which it seems to regain its refractive powers, in other words, its brilliancy.

In cutting over such a pressed article, this thin skin of refractive glass would be abraded, and the brilliancy of the whole article impaired.

The value of cut glass is in proportion to its purity of color and the brilliancy of the "metal," or glass; and it is a matter in the experience of every glass maker that a pressed article cut over is *not* as brilliant as the same piece not cut, and having the fire polished or reheated surface intact. Hence, though it is cheaper to press a piece first, and then cut over the pattern, such goods are so inferior that they would not bring as much as the merely pressed and fire polished article.

It can be considered a rule that the less pressure there is put on the glass while bringing it into shape, the more brilliant the final cutting will appear.

These remarks may be verified by a visit to the Dorflinger Flint Glass Co., White Mills, Pa., or to the Mt. Washington Glass Co., New Bedford, Mass., where the reader may make himself fully acquainted with all the details of the manufacture of cut glass proper. ANDREW GOTTSCHALK.

A New Method of Blasting.

Dr. Kosman proposes, in blasting in fiery mines, to substitute for gunpowder, dynamite, and other explosives requiring ignition, cartridges containing zinc dust (the mixture of finely divided zinc and zinc oxide that collects in the condensers of the zinc retorts) and diluted sulphuric acid. The cartridge case is a glass cylinder, 7 inches long and 1 inch in diameter, closed at the bottom, and divided into two parts, whose volumes are in the proportion of 1 to 4, by a choking or contraction, which reduces the bore at the junction of the two chambers three-tenths or four-tenths of an inch. The lower or larger division is filled with diluted sulphuric acid, and the contracted opening is stopped with a plug of cork, India rubber, or asbestos, in which state it is given to the miner.

When required for use, the upper part of the case is filled with zinc dust, and the shooting needle is passed through it into the plug closing the acid chamber. The shot hole is loaded and tamped in the ordinary way, first with tempered and then with dry clay or broken up shale. If the rock is porous or jointed, the hole should be carefully clayed, to prevent the gas escaping through the cracks. The shot is "fired" by one or more smart blows on the shooting needle, which drives in the plug and breaks the glass at the choked part, when the zinc dust mixes with the acid, and a rapid, although not instantaneous, evolution of hydrogen takes place, whose expansive power is sufficient to break down the rock. The following figures are given as a measure of the power available:

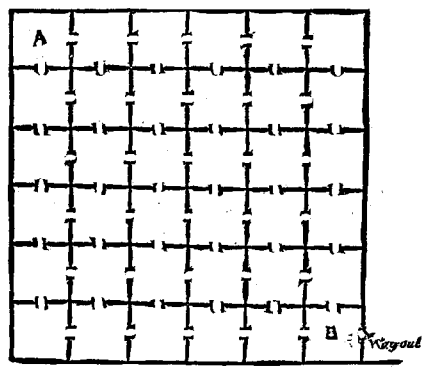
A cartridge of 25 millimeters in diameter and 180 millimeters long is approximately of the capacity of 90 cubic centimeters. The charge consists of 50 cubic centimeters of sulphuric acid and 12 grammes of zinc dust, which, according to its average commercial composition, will contain about 10 grammes of metallic zinc.

According to the formula, $Zn + H_2SO_4 = ZnSO_4 + 2H$, 10 grammes of zinc will liberate 0·3 gramme of hydrogen, or by volume 3·37 cubic meters (1 cubic meter of hydrogen at 760 millimeters barometer pressure weighs 0·089 gramme). This volume of gas being confined to 90 cubic centimeters, the resulting pressure will be $\frac{3{,}370{,}000}{90} = 37{,}000$ atmospheres in round numbers. This is computed at zero, but at higher temperatures, such as prevail in mines, the pressure will be notably greater. In blasting with gunpowder, the pressure developed is below 5,000 atmospheres. The production of the cartridge cases has been intrusted to a single firm, in order to obtain uniformity in the manufacture. The cost of a shot will vary with the caliber and weight of the charge, from about 1½d. to 2d.

The question whether danger might be apprehended from the sudden addition of a large volume of hydrogen to the air of mines already containing inflammable gas must, Dr. Kosman thinks, be answered in the negative, as hydrogen diffuses so rapidly in atmospheric air that the power of inflaming is soon dissipated. For instance, if zinc dust is covered with diluted sulphuric acid in an open dish of 500 cubic centimeters capacity the gas cannot be fired by a naked light at the edge of the dish, and the flame must be applied to the bubbles of hydrogen as they form to obtain a detonation. This rapidity of diffusion is likely, therefore, to prevent any danger by the addition of hydrogen to the air in mines which are well ventilated and worked with safety lamp. The heat developed by the action of the acid upon the zinc also causes a considerable development of steam, which, mixing with the gases, acts in diminution of the explosive power. These and other points can, however, only be settled by experiment on the large scale.

A PUZZLE.

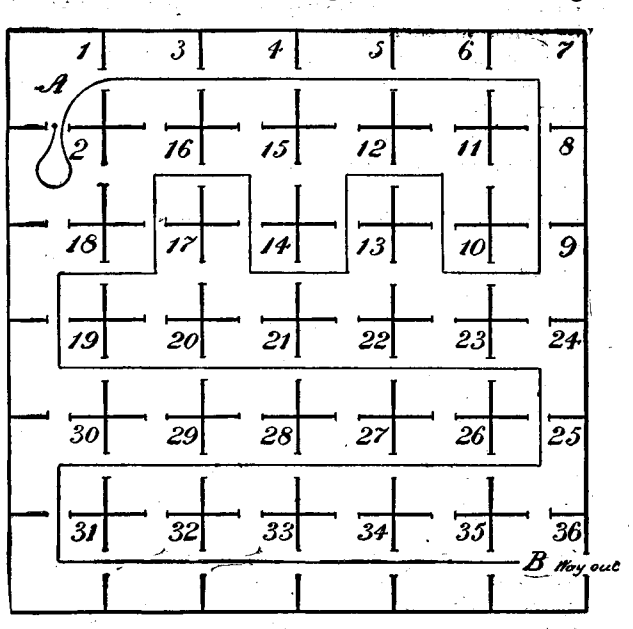
The following, I believe, has a solution, but what that solution may be I by no means promise to tell—for a most excellent reason.



The figure represents the plan of a prison with intercommunicating cells (bless the Latin!); a prisoner in A is offered his freedom if he can make his way to B, after passing once, and once only, through all the 36 cells. How is he to do it?—*Knowledge.*

The above is the puzzle as published in our number of January 15, page 36. We have received a large number of replies, some of which deny the possibility of its solution if the exact terms are complied with. Others find no difficulty in its solution in the manner stated as follows by one of our correspondents:

The prisoner says to the keeper: "Come, we will go



through room No. 2; now we will go through my room No. 1, then No. 3, and so on as per diagram. In this way we go through all the 36 rooms once, and once only." W. P. MURPHY.

Ridgway, Elk County, Pa.

Crown Jewels of France.

Since France has been under republican rule, the disposition of state treasures has been a subject of frequent discussion in her legislative halls. At one time the money obtained for the crown jewels was to be applied to the founding of trade schools, and the collection was exhibited once in the Tuileries in order to help the metal workers in setting up a special school for their apprentices. Now it is said that the products of the sale are to be turned into the treasury. The whole collection is not to be sold. Three objects are to go to the melting pot, viz., the Imperial crown, the glaive of Louis XVIII., and the glaive of the Dauphin. Several of the stones will be handed over to the Mineralogical Museum and the School of Mines, to be used henceforth as specimens. A few objects will be preserved as curiosities, viz., the military sword, the reliquary brooch, the Regent diamond, the Mazarin diamond, the watch presented by the Dey of Algiers, the large ruby, the dragon pearl, and the badge of the Little Elephant of Denmark. The remaining treasures will be treated as if they were seized for debt, and will be sold by auction in the Hotel Drouot.

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The Geological Survey of New Jersey.

We have received from Prof. Geo. H. Cook, State Geologist of New Jersey, three sheets of the topographical map of the State, now in process of completion. Each sheet is 27 by 37 inches in size. Seventeen sheets are to complete the State, of which thirteen have been issued, and the completion of the work is promised in 1888. The scale is one inch to the mile, and the country is laid out in 10 foot contour lines, with special references to heights of points of interest. The work, now so near completion, is of the highest interest and value to all interested in the State of New Jersey. The execution of the maps is most excellent, the work being done by the well known firm of Julius Bien & Co., so long associated with government map work. We also note the receipt from the same survey of the agricultural station report, giving interesting statistics upon the sorghum plantation at Rio Grande, and the results attained by the diffusion battery in extracting sirup from the cane. This review of the well known experiment in northern sugar culture will be appreciated by all sugar manufacturers and planters.

Injury to the Brain.

A most remarkable accident, illustrating the necessity of using the greatest care in fixing cutting tools in machines, is reported in *Science*. While a wood turner of San Francisco was at work at his trade, a steel chisel became detached from a grooving machine, and struck him in the head, producing a fracture of the bones of the nose, and severely injuring the left eye, so seriously as to destroy that organ and necessitate its removal. After the removal of the eye, the surgeons found behind it a piece of steel 3½ inches long, one inch wide at the center, and tapering to sharp points at the ends. One end was buried 1½ inch in the brain. The velocity and force with which this chisel must have entered the brain may be imagined when it is stated that the drum to which it was attached was making 2,300 revolutions a minute. The injury to the brain was not discovered until several days afterward, and the man died at the tenth day.

Cleaning Cherry or Ash.

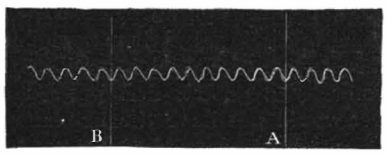
As the proper cleaning and finishing of oak or cherry require considerable care and skill, it will be interesting to notice the practical treatment which the woods undergo under the hands of the woodworker.

Cherry, as in tables, framing, etc., is usually roughed off by the planing machine and worked into its required shape before finishing. When, as in the case of a veneered door, the frame is ready for cleaning off, it is laid on and firmly fastened to the bench by strips cut in between the joggles, then carefully surfaced or leveled over with the fore plane. This is in itself a delicate operation, as the surfaces of the pieces must be exactly flush under a straight edge—that is to say, across the face stiles must be on the same level as the face of the rails, and the latter on the same level as the mullions; in short, the surfaces must all be in the same plane and the stiles likewise straightened. All lumps must be reduced, and great caution exercised to avoid sprawling corners. Use the plane with the grain, as the contrary works out holes, and causes more trouble with the smoother. This done, it is usual to smooth off with a closely set, well-sharpened plane, or, better still, a Bailey iron plane. Some woodworkers object to using the iron plane, as it marks the stuff, and causes much scraping afterward, but it never breaks corners, and will work well against cross-grained stuff like this. Having finished smoothing, proceed to scrape the surface with a scraper which will cut to a shaving. Work carefully with the grain and take out all holes and rough spots, especially near the joints. When scraping across joints, bend the scraper with the hands, and avoid tearing up the grain on either side of the joint. Obliterate every imperfection noticeable before applying the sandpaper, which should be No. 1, and used with a broad, flat cork rubber. On no account sandpaper across the joints, as the grit in the sandpaper will score across the sensitive surface, but work close to the end-wood joint and then with the grain of the jointed stile or rail, as the case may be. Of course the result of the operation depends on the operator's skill, but an exceedingly neat job can be done with a little care.

Ash is, perhaps, the most difficult of all the woods to clean, as the grain is of an open and straight nature, varied with a frequently recurring tough cross spot. Like cherry wood after going through similar treatment, it shows a beautiful surface, which, being filled and varnished or polished, looks rich and glossy, the one dark and warm and the other light and elegant. After sandpapering, rough spots are seen by white blotches, and they can be easily scraped out as before. In these days, when pine is almost obsolete and the hardwoods growing in favor, it is essential that their treatment be understood.—*Owen B. Maginnis in Milling News.*

LONDE'S METHOD OF TIMING PHOTOGRAPHIC EXPOSURES.

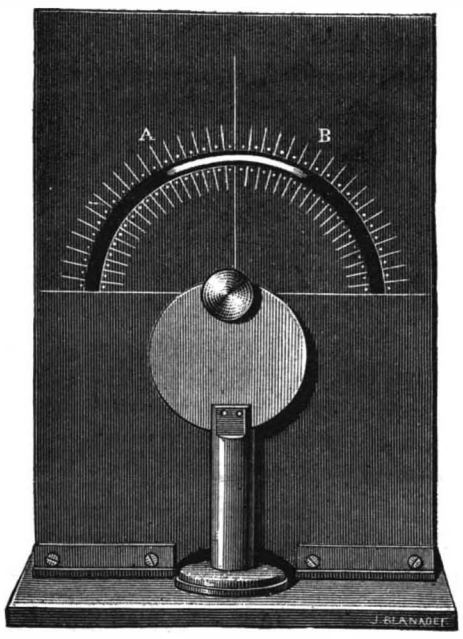
The process illustrated in the cuts is a development or improvement by M. A. Londe of M. Vidal's method. To make it perfectly accurate, a tuning fork is used to determine the absolute time. The tuning fork, as a measurer of time, is the only one whose accuracy cannot be questioned, and we believe that, instead of its being restricted to the hands of scientists, it should



3.—REPRODUCTION OF THE SINOIDAL CURVE IN LONDE'S METHOD.
A.—Beginning of the Impression.
B.—End of the Impression.

be used for our advantage in the interest of our researches.

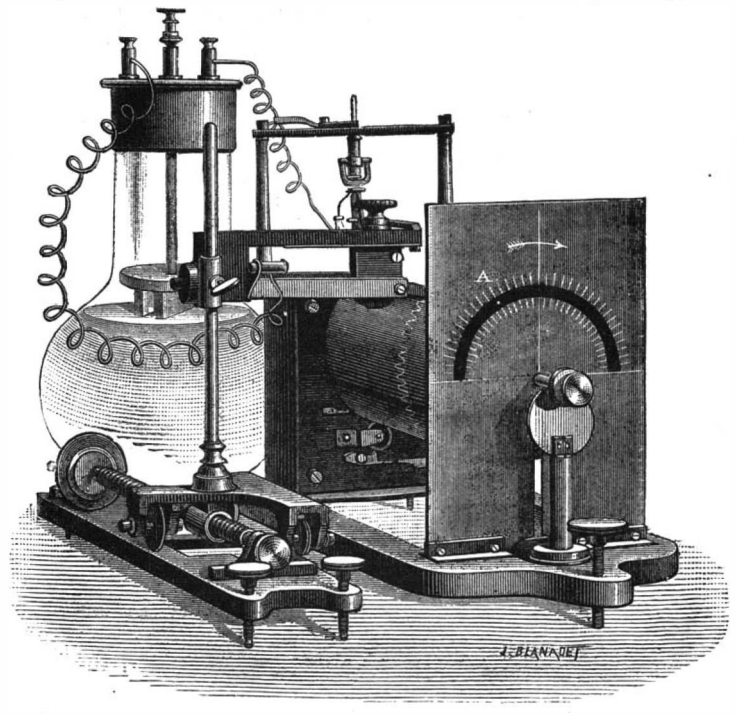
It will probably be objected that such methods as here described cannot be used by every one. This is indisputable, but it seems clear that to measure hundredths and thousandths of a second requires instruments of great precision, or else it is useless to occupy one's self with such work. To measure such small fractions of seconds by approximate methods appears to us as



2.—REPRODUCTION OF A PROOF OBTAINED BY LONDE'S METHOD.
A.—Beginning of the Luminous Impression.
B.—End of the Luminous Impression.

of the same nature as weighing milligrammes with gramme weights. As soon as these problems are attacked, the utmost precision is required. In this order of ideas, we have devised the following apparatus:

A registering cylinder is governed by a Foucault regulator. On its end is placed a bright point, a nickel plated head of a nail, for example. The point and cylinder move together. It is its displacement that we photograph. It moves behind a graduated screen pierced with a segmental opening (Fig. 1). The screen



1.—LONDE'S METHOD OF TIMING EXPOSURES.—A, BRILLIANT POINT.

is black; the divisions are white. The cylinder is covered with smoked paper, over which an electric tuning fork carrying a light needle point vibrates. A photographic apparatus is focused upon the dial. The regulator is started, the stylus of the tuning fork is made to touch the paper, and the shutter is released.

The result of an experiment is here reproduced (Fig. 2). The divisions of the dial and the trace, A B, left by the brilliant point are shown clearly. The light began to act at A, and ceased at B. On our sinoidal curve we now must determine to which places these two points correspond, and what time passed between A and B. Nothing is simpler. The cylinder is turned by hand until the point is at A. Here the impression begins. We trace therefore a line which cuts the sinoidal curve, by moving the tuning fork along on its car. The point, A, is referred to the point of intersection of this line and of the curve of sines. The cylinder is rotated until the point reaches B. We trace a second sine, which gives the point corresponding to B. The number of vibrations comprised between A and B must now be counted, to ascertain for what period the light has acted, to know the value of the time of exposure. In the experiment illustrated 10 vibrations took place; the tuning fork gave 250 per second; the time of exposure was 10 250 of a second, or 1-25 (Fig. 3).

In this method, combining graphic and registration methods, regulated movement is not required, as the law of movement of the cylinder is always known. The dial need not be divided with accuracy, as its graduation is only used to establish the positions. The method is really a simplification, while giving most accurate results.—*La Photographie Instantanée, by Albert Londe.*

Protection of Iron.

M. De Meritens, in continuing his experiments upon the protection of iron, has obtained some further results, which seem likely to be of practical importance. The method of protecting an iron or steel surface by the electrolytic formation of a coating of the black magnetic oxide has already been taken up in France as a commercial process. Experiments in this direction have also been undertaken by the French arsenals, and are understood to have led to satisfactory results. M. De Meritens describes his later researches in a note presented to the French Academy, as follows:

"When we submit a piece of iron to the action of the current in a bath of cold water, the formation of magnetic oxide does not immediately take place. The surface of the metal is in the first place coated with a layer of the protoxide of iron. This is a body of which little is known at present. It has not been completely studied by any chemist. Berzelius undertook a prolonged investigation of the substance, but he has never completed the work. The protoxide is the least stable of the oxides of iron. If it is produced by precipitation from a salt of iron, it is immediately converted into the sesquioxide. A similar conversion into the higher oxide takes place when the protoxide formed upon the surface of the metal by electrolysis is exposed to the air, or if the electrode is allowed to remain in the bath after the cessation of the current. If, however, the sheet of iron coated with the protoxide is immediately transferred to a bath containing a solution of a suitable salt of some other metal, such as copper, silver, gold, or aluminum, a perfectly adherent layer of this metal is immediately formed upon the iron. It is probable that the action is due to a partial reduction of the protoxide by hydrogen and the formation of an actual alloy between the two metals, both of which are at the moment in the nascent condition."

M. De Meritens exhibited specimens of iron coated by this process with the several metals named above.

A Candy Temperance Society.

At a recent meeting of the Nineteenth Century Club, of New York City, Dr. Hammond addressed the audience on the subject of "Brain Forcing in the Education of Children." Miss Tate, the principal of one of the city public schools, refuted the idea of any brain injury resulting from the ordinary education, according to the school system. Candy she affirmed to be the evil in the daily life of a large proportion of the youthful maidens of the country. The *Hour* thinks the formation of a temperance society for controlling this particular vice would seem to be as essential to the progress of the country as the suppression of whisky where men are concerned. In fact, cream caramels have never before been presented to the public under so fatal an aspect. A large gathering listened with evident satisfaction to the speakers of the evening. Among those present were Mr. and Mrs. Wm. Hamilton, Mr. and Mrs. Stickney, Professor and Mrs. Boyesen, and Mrs. Bernard. The Marquise De Lanza and Mrs. Charles H. Stebbins received the guests.

IT is reported from Maine that the English sparrows are becoming acclimated, and growing white.

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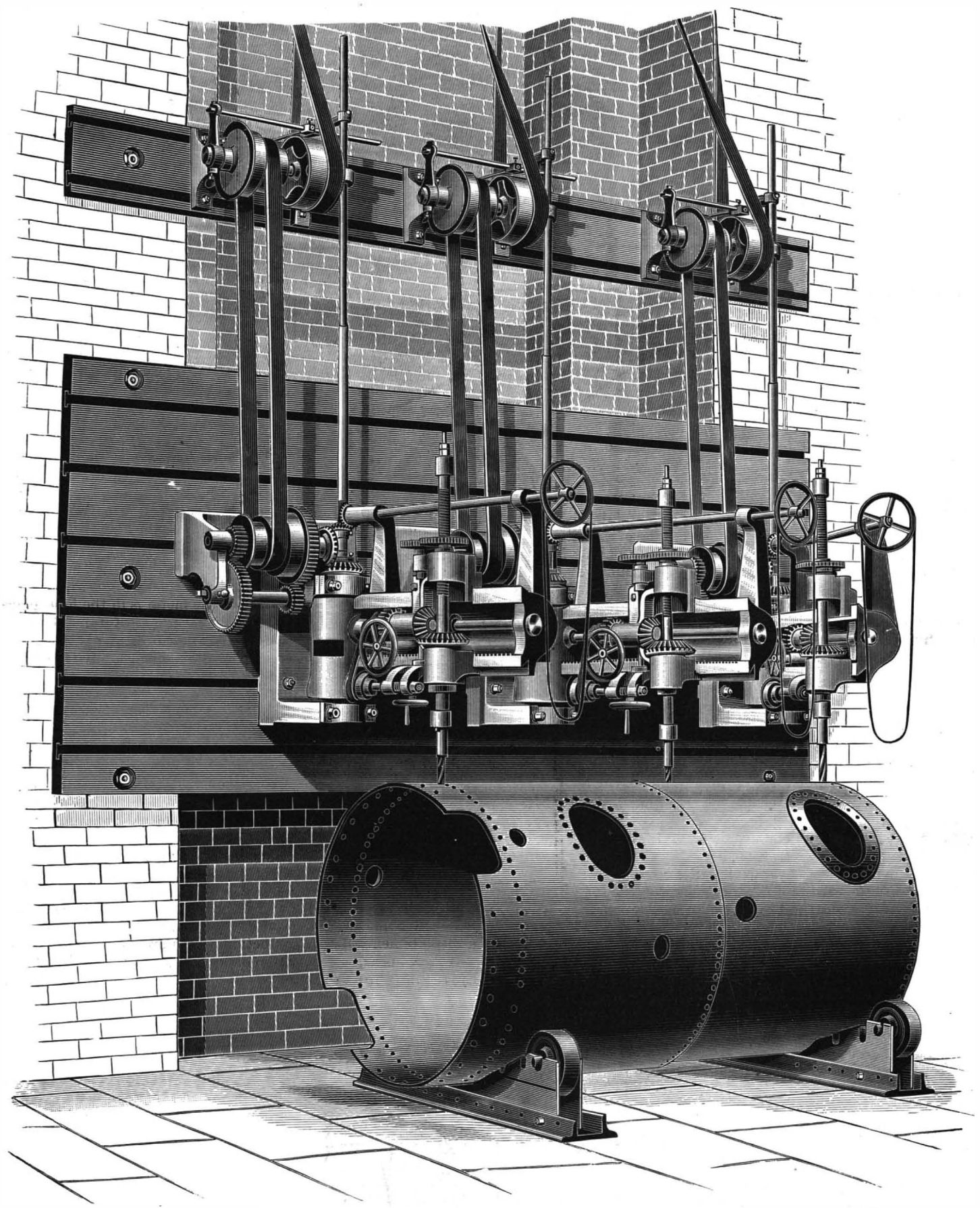
MULTIPLE DRILLING MACHINE.

We illustrate a special drilling machine made by Francis Berry & Sons, of Sowerby Bridge, England, this machine having been specially arranged, says *Engineering*, for the use of manufacturers of vertical and horizontal boilers, steam cranes, portable engines, etc.

As will be seen from the engraving, the machine consists of three double-geared radial drilling machines, each with a radius of 4 feet, each radial arm having a steel spindle 2 inches in diameter and a self-acting and hand feed range for a depth of 12 inches. These drills are bolted to a cast iron wall plate 14 feet 6 inches long by 6 feet 3 inches wide, planed perfectly true, and with six T slots, equidistant, planed out, and running from end to end. This plate carries the three drills, and by means of the T slots these drills can be moved into various positions, either vertically or horizontally, within the limits of the plate, to suit the work to be operated upon.

The top driving apparatus is also bolted to a wall plate with T slots from end to end, so that the driving apparatus can be moved along to suit the varying position of the drills.



IMPROVED MULTIPLE RADIAL DRILLING MACHINE.

The Car Heating Problem.

The recent accident at White River Junction has caused the passing of a resolution in the Connecticut Legislature, asking that the Committee on Railroads be instructed to make a thorough examination of the methods employed in heating railroad cars in that State, and report whether legislation is necessary to secure greater security to the public.

The frequency of accidents and loss of life arising from car-heating stoves is awakening public attention everywhere, and even railroad officials are beginning to realize the necessity for some safer means of warming their cars than are now in use. The heating of cars by steam from the locomotive would seem to be the most effective and the least objectionable method; but railroad engineers are almost unanimous in their condemnation of the use of steam for the purpose.

Mr. Chauncey M. Depew, President of the New York Central Railroad, in a recent interview said, in substance, that steam could not be used on long trains or for long distances.

Mr. Frank S. Bond, Vice-President of the five thousand miles of Chicago, Milwaukee, and St. Paul road, confirms Mr. Depew in his statement. Mr. Depew, further referring to the difficulties attending car heating, said that wealth awaits the man who invents a remedy. He had thought of fireproof cars, but concluded that they would not satisfy the public, for they must be constructed without much ornamentation, and "I know by experience," says Mr. Depew, "that the pampered public will take the chances of burning to death in a luxuriously upholstered coach which holds $10,000 worth of inlaid woods, lincrusta-walton designs, ornate carvings, frescoes, velvet carpets, and portieres, rather than insure their lives in a plain iron car that no incendiary could destroy."

In conversation with a railroad official of Providence, he tells us that car heating has been a subject of much study and many experiments in the construction departments of most of the important railroads, and it has heretofore been claimed by the companies that the coal stove, inclosed in a wrought iron case, kept securely fastened, was the safest and best plan yet devised for heating. The Pullman Car Company have adopted this mode of heating on most of their drawing room and sleeping cars, and they have probably given the subject as much thought as any one. But, says our informant, there is another element very slightly less dangerous than the car-heating stove, and that is the lighting appliances used in all passenger cars. The reservoirs of the several lamps contain considerable oil or other inflammable substance, and, being suspended along the length of the car, some one or more are likely to be crushed in even a slight collision, and the danger from this cause is one that has not received the attention it deserves. Electric lighting and steam heating, by means practically available under the present conditions of railway business, are among the most important problems at present inviting the attention of inventors.

As the adoption of fireproof cars has been suggested, we find, as long ago as 1851, Thomas E. Warren, of Troy, N. Y., planned a metallic railroad car, which was illustrated in the SCIENTIFIC AMERICAN, August 23, 1851, vol. vi., p. 388, and the cut represents the car to be very graceful, equal in form and ornamentation to most passenger cars of to-day. We copy from the description accompanying the engraving: "The posts are made of wrought iron plates and constructed tubular, thus combining great strength and extreme lightness. The panels are of lighter wrought iron plates than the posts, and the roof is of sheet iron. The car is lined with a non-conducting material, so as to render it cool in summer and warm in winter."

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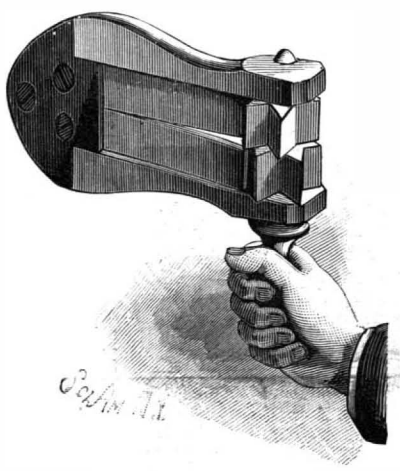
SCIENCE IN TOYS.

VII.

The student of acoustics need not go beyond the realm of toys for much of his experimental apparatus. The various toy musical instruments are capable of illustrating many of the phenomena of sound very satisfactorily, if not quite as well as some of the more pretentious apparatus.

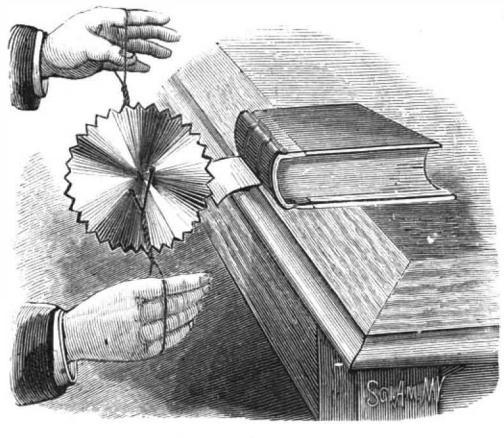
Sound is a sensation of the ear, and is produced by sonorous vibrations of the air. It may be in the nature of a mere noise, due to irregular vibrations, like the noise of a wagon on the street, or it may be a sharp crack or explosion, like the cracking of a whip or like the sound produced by the collision of solid bodies. The clappers, or bones, with which all boys are familiar, are an example of a class of toys which create sound by concussion, and the succession of sounds produced by the clappers are irregular, and clearly distinct from musical sounds. A succession of such sounds, although occurring with considerably frequency and perfect regularity, will not become musical until made with sufficient rapidity to bring them within the perception of the ear as a practically continuous sound. The rattle, or cricket, produces such sounds.

CLAPPERS.



THE CRICKET, OR RATTLE.

The wooden springs of the cricket snap from one ratchet tooth to another, as the body of the cricket is rapidly swung around, making a series of regular taps, which, taken all together, make a terrific noise, having none of the characteristics of musical sounds. That a musical sound may be made by a series of taps is illustrated by the buzz, a toy consisting of a disk of tin having notched edges and provided with two holes on diametrically opposite sides of the center, and furnished with an endless cord passing through the holes. The disk is rotated by pulling in opposite directions on the twisted endless cord, allowing the disk to twist the cord in the reverse direction, then again pulling the cord, and so on.



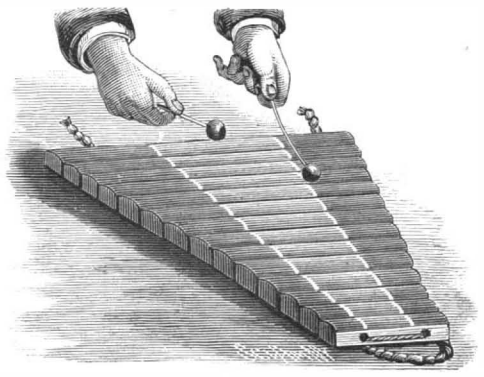
THE BUZZ

If, while the disk is revolving rapidly, its periphery is brought into light contact with the edge of a piece of paper, the successive taps of the teeth of the disk upon the paper produce a shrill musical sound, which varies in pitch according to the speed of the disk. Such a disk mounted on a shaft and revolved rapidly is known as Savart's wheel.

It is ascertained by these experiments that regular vibrations of sufficient frequency produce musical sounds, and that concussions, irregular vibrations, and regular vibrations having a slow rate, produce only noises.

Savart determined that the lowest note appreciable by the ear is produced by from seven to eight complete vibrations per second, and the highest by 24,000 complete vibrations per second.

The zylophone and metalophone are examples of musical instruments employing free vibrating rods supported at their nodes. The zylophone consists of a series of wooden rods of different lengths, bored transversely at their nodes, or points of least vibration, and strung together on cords. The instrument may either be suspended by the cords or laid upon loosely twisted cords situated at the nodes. By passing the small spherical wooden mallet accompanying the instrument over the wooden rods, very agreeable liquid musical tones are produced by the vibration of the rods, and when the rods are struck by the mallet they yield tones which are very pure, but not prolonged.

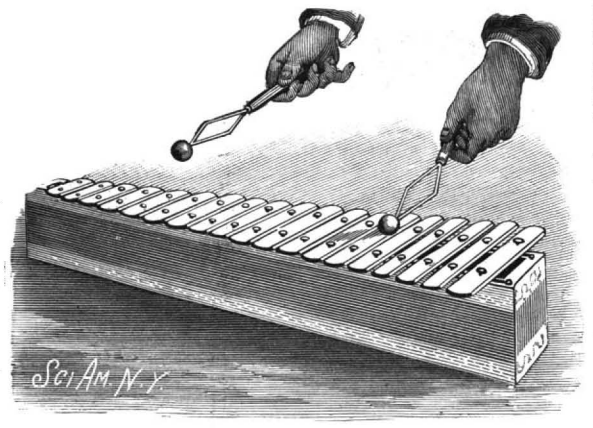


THE ZYLOPHONE.

The cheaper forms of zylophone are tuned by slitting the rods transversely at their centers on the under side, by means of a saw, to a depth required to give them the flexibility necessary to the production of the desired tones. The rods are divided by the nodes into three vibrating parts, the parts between the nodal points and the ends being about one-fourth of the distance between the two nodes.

The metalophone is similar in form to the zylophone, but, as its name suggests, the vibrating bars are made of metal—hardened steel. The bars rest at their nodes on soft woolen cords, secured to the upper edges of a resonator forming the support of the entire series of bars. The resonator is tapered both as to width and depth, and serves to greatly increase the volume of sound.

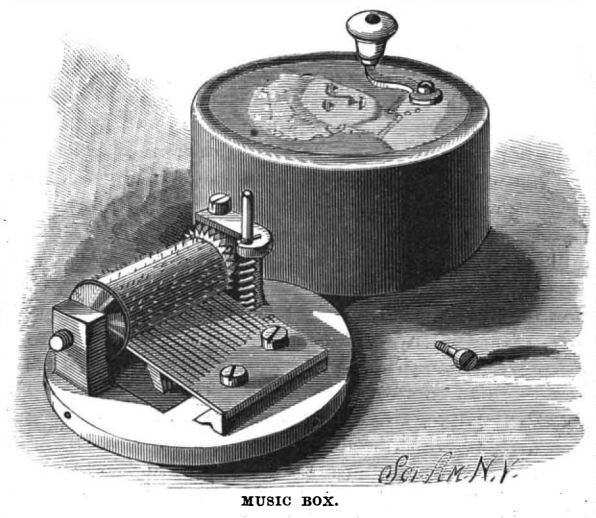
The resonator has a depth equal to half the length of a sound wave. When a bar is struck, its downward movement produces an air wave which moves downward, strikes the bottom of the resonator, and is reflected upward in time to re-enforce the outwardly moving air wave produced by the upward bending of the bar.



THE METALOPHONE.

The metalophone yields a sweet tone, which is quite different from that produced by the vibration of wooden bars.

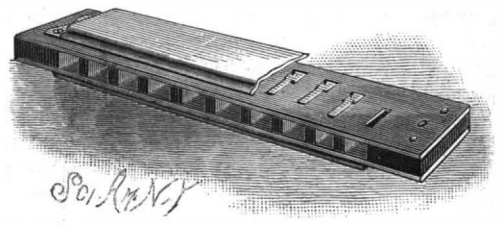
The music box furnishes an example of the class of instruments in which musical sounds are produced by the vibration of bars or tongues which are rigidly held at one end and free to vibrate at the other end. The tongues of the music box are made by slitting the edge of a steel plate, forming a comb, which is arranged with its teeth projecting into the paths of the pins of the cylinder, which are distributed around and along the cylinder in the order necessary to secure the required succession of tones. The engagement of one of the pins of the cylinder with one of the tongues raises the tongue, which, when liberated, yields the note due to its position in the comb.



MUSIC BOX.

The tongues are tuned by filing or scraping them at their free or fixed ends, or by loading them at their free ends. In this instrument the sonorous vibrations are produced by the tongue, which itself has the desired pitch.

In reed instruments the case is different. The sound is not emitted by the reed, but sonorous vibrations are produced by air pulsations, controlled by the reed, which acts as a rapidly operating valve. The mouth organ, or harmonica, is a familiar example of a simple reed instrument.



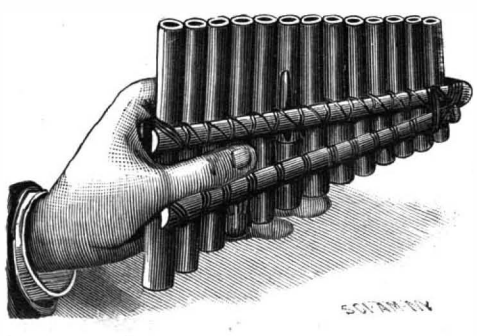
MOUTH ORGAN, OR HARMONICA.

When reeds are employed in connection with resonating pipes, as in the case of the reed pipes of an organ, the pipe synchronizes with the reed, and re-enforces the sound. When the reed is very stiff, it commands the vibrations of the air column, and when it is very flexible, it is controlled by the air column.

The horn is a reed instrument in which the lips act as reeds, and the tapering tube serves as a resonator.

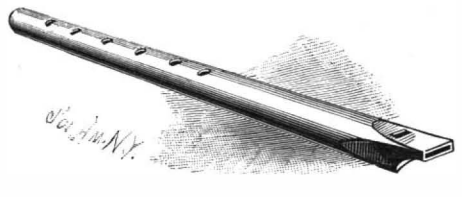
THE BUGLE.

The ancient Pandean pipes present an example of an instrument formed of a series of stopped pipes of different lengths. These pipes are tuned by moving the corks by which their lower ends are stopped, and the air is agitated by blowing across the end of the tubes.



PANDEAN PIPES.

The flageolet is an open pipe in which the air is set in vibration by blowing a thin sheet of air through the air slit of the mouthpiece against the thin edge of the opposite side of the embouchure. The rate of the fluttering produced by the air striking upon the thin edge is determined by the length of the pipe of the instrument, the length being varied to produce the different notes, by opening or closing the finger holes. By comparing the flageolet with the Pandean pipes, it is found that for a given note the open flageolet pipe must be about twice as long as the Pan pipe. When all the finger holes of the flageolet are closed, it is then a simple open pipe, like an organ pipe, and, if compared with the Pan pipe yielding the same note, it is found to be just twice as long as the closed pipe. If,



FLAGEOLET.

while the holes are closed, the open end of the flageolet pipe be stopped, the instrument will yield a note an octave lower. These experiments show that the note produced by a stopped pipe is an octave below the note yielded by an open pipe of the same length, and the same as that obtained from an open pipe of double the length.

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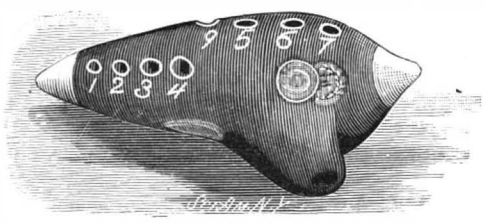
The ocorina is a curious modern instrument, of much the same nature as the flageolet. It is, however, a stopped pipe, and shows how tones are modified by form and material, the material being clay. It pro-

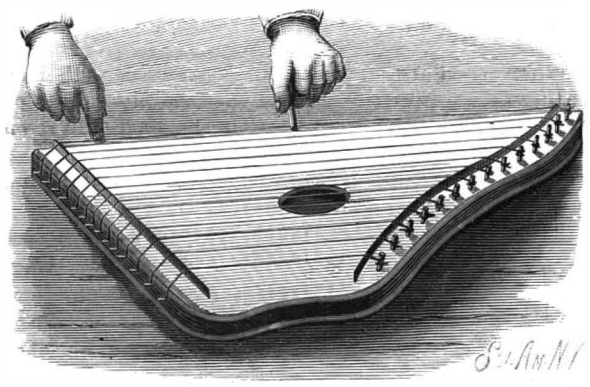


OCORINA.

duces a mellow tone, something like that of a flute.

The zither, now made in the form of an inexpensive and really serviceable toy, originated in Tyrol. It consists of a trapezoidal sounding board, provided with bridges, and having 24 wire strings.

Its tones are harp-like, and with it a proficient player can produce agreeable music. Much of the nature of the vibration of strings may be exhibited by means of



ZITHER.

this instrument. By damping one of the strings by placing the finger or a pencil lightly against its center, and vibrating the string, at the same time removing the pencil, the string will yield a note which is an octave higher than its fundamental note. By examining the string closely, it will be ascertained that at the center of the string there is apparently no vibration, while between the center and the ends it vibrates. The place of least vibration at the center of the string is the node, and between the node and the ends of the strings are the venters. It will thus be seen that the string is practically divided into two equal vibrating segments, each of which produces a note an octave higher. That the note is an octave higher than the fundamental note may be determined by comparing it with the note of the string which is an octave above in the scale of the zither.

By damping the string at the end of one-fourth of its length, the remaining portion of the string divides itself into three ventral segments, with two nodes between.

The division of the string into nodes and venters occurs whenever the string is vibrated, and all of the notes other than the fundamental are known as harmonics, and impart to the sound of the string its quality.

By tuning the first two strings in unison, the vibration of one string by sympathy with the other string may be shown.

The string telephone, although not a musical instrument, nor even a sound producer, exhibits an interesting feature in the conduction of sounds. It consists of two short tubes or mouthpieces, each covered at one end with a taut parchment diaphragm, the two diaphragms being connected with a stout thread. By stretching the thread so as to render it taut, a conversation may be carried on over quite a long distance, by talking in one instrument and listening at the other. The vibration of one diaphragm, due to the impact of sound waves, is transmitted to the other diaphragm by the thread.

TELEPHONE.

In the toys illustrated we have a representative of the Savart's wheel in the buzz; of the pipe organ in the Pan pipes, the flageolet, and the mouth organ; of band instruments in the bugle; and of the piano, harp, and other stringed instruments in the zither.

G. M. H.

DEVON CATTLE.

If it be true that "self-color," that is, a uniformity of color in all parts of the body, is proof of antiquity of breed, then the Devons have decidedly a valid claim to be considered a strictly aboriginal race. Red is the true Devon color, though the shade varies from a rich dark to a pale chestnut. Animals marked with any other color are not considered true Devons. Naturalists consider the Highland Kyloes, one or two of the Welsh breeds, and the Devons the descendants, more or less changed by crossing, soil, and climate, of the small Celtic breed, Bos longifrons, common on the island before and during the Roman occupation; but which was superseded by larger varieties of the Bos urus or Bos primigenius introduced by the Danish and Teutonic conquerers of Britain.

Certainly as far as history or tradition goes back, the northern part of Devon has possessed a breed of self-colored red cattle, whose compactness, general beauty, hardiness, activity as workers, and aptitude to fatten have endeared them to their owners and won them a wide celebrity. The southern part of the county has had cattle possessing the same general characteristics of form and color; but somewhat larger, coarser, and less active. In the northern part, the land is, in great part, poor, bleak, wet, and exposed; while in the southern part the land is rich, and the climate more congenial, hence the difference is due to variations in soil and climate, though some influence has probably been exercised by crosses of the old Somerset and Cornish cattle—both larger strains. Although for the past century great attention has been paid to improving the North Devons, no infusion whatever of the blood of any other variety of cattle has been made, and as Devons, no improvement could be made by such means.

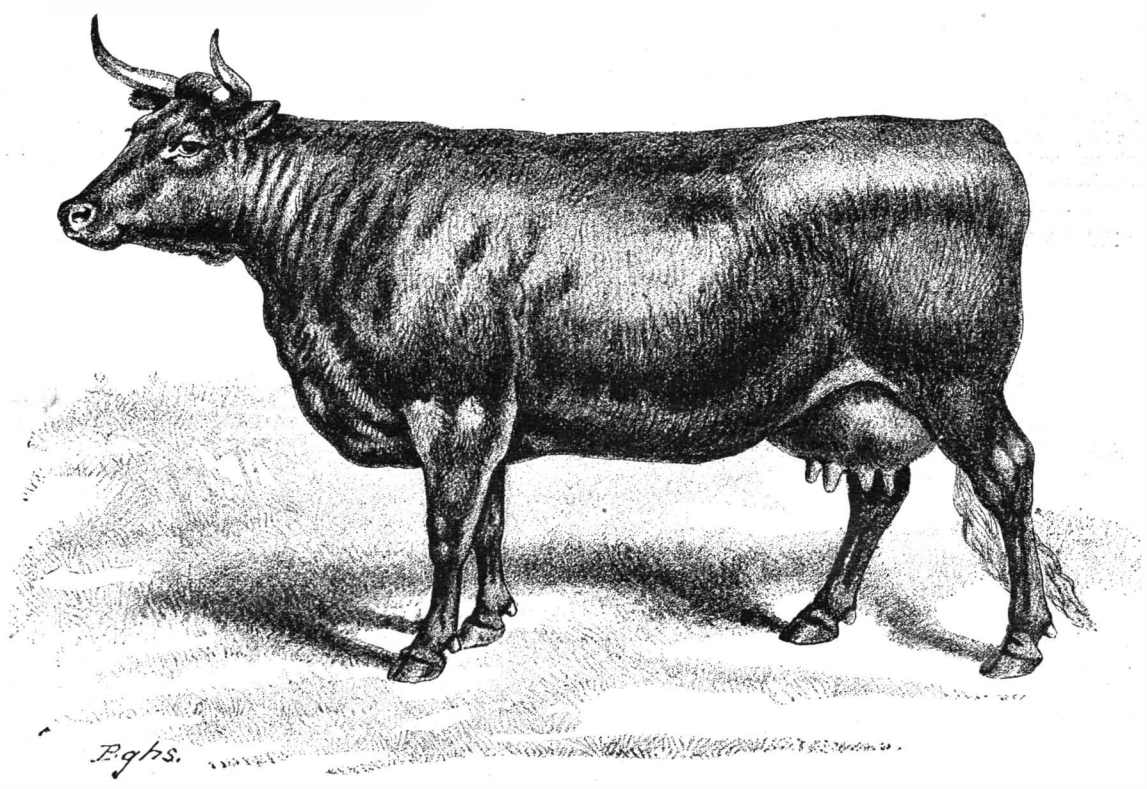
In size, the Devons are medium; but there is a great difference between the ox, bull, and cow. The first, full grown and in good working condition, will range from 1,400 to 1,600 pounds live weight; the second, from 1,000 to 1,200; and the third, from 800 to 1,000. Specimens sometimes exceed the greatest of these weights, but they are above the average. With luxuriant pastures and generous feed the size increases, and it is found that Devons on the rich fields of the West become larger than their congeners on the scanty pastures of New England.

Devons are the prevailing cattle in several districts in the southern counties of England, and there are there a considerable number of dairy herds of the breed. While there are several large milk and butter records of Devon cows, they have, as a breed, never been famous for giving large quantities of milk; but their milk is rich in quality, and Devonshire cream has a world-wide reputation. It is said that a gallon of Devon milk will yield more butter than a gallon of milk from any other breed, except the Jersey. It is only in comparatively recent times that much attention has been paid to the development of milking qualities in the Devon; for in times past, the Devon, like the Hereford, was raised chiefly with a view to the development of the male for working purposes. Hence the greatly smaller size of the cow, a point which should decidedly be considered in speaking of her yield of milk. In view of her hardiness, her ability to pick up a livelihood where a Short Horn, Holstein-Friesian, or any of the larger breeds would starve, her docility of temper under good treatment, and the comparatively small amount of food she requires, the Devon often gives a good profit in the dairy.

For work, Devon oxen are among cattle what thoroughbreds are among horses. In view of their size, they combine more fineness and strength of bone, more muscular power, more intelligence, spirit, and bottom than oxen of any other breed. Their slanting shoulders fit them better for the yoke than beasts of any other breed, except, perhaps, the Herefords. The nearer any other breed approaches Devons in shape and action, the more valuable are they, according to weight, for the plow, the cart, or the wagon. Their uniformity in style, shape, and color renders them easily matched, and their docility, intelligence, and activity make them excellent working animals, especially on light soils or a hilly or rough country.

At the great London Smithfield Fat Stock Show, the post of honor is always given to the Devons as beef animals, and in the English markets their meat, compact, sweet, marbled, and juicy, brings from one to two cents a pound more than that of any other breed, except the West Highland, and comparisons with other breeds go to show that on a given quantity and quality of food, they will make more beef than almost any other. Their bones, too, are very fine, and the amount of offal is small in proportion to the meat. When fattened for the butcher, the Devon matures early, and, for its weight, is probably the most profitable beef animal in existence.

It is likely that Devons were imported as long ago as the last century into this country, especially into New England, where working oxen of their type have long been more numerous than in any other section. But the earliest published records do not go back farther than the importation of Winthrop and Davenport, in 1800; while the first really important early importation was that of Caton & Patterson, of Baltimore, in 1817, from which most of the recognized pure bred American Devon herds have derived more or less of their blood. Lately, Devons have taken a more prominent place than ever before at our fairs, and are steadily advancing in popular favor, both for beef, dairy, and working purposes. The publication of the "Devon Herd Book" was begun in England in 1851, by Captain Davy, by whom it is still kept up. The "American Devon Herd Book" was established in 1880, and has since been published by James Buckingham, Zanesville, Ohio, under the direction of the American Devon Association.—*Rural New-Yorker.*



DEVON COW.

Nitrate of Mercury for Burglars.

Dr. Edwin F. Rush, whose house in Chicago has been despoiled by burglars eight times the past year, recently conceived a plan to play havoc with the marauders, claiming that the police have afforded him no protection. He has a fine home at Warren and California Aves. Three days ago the doctor placed tubes, containing fulminate of mercury, with nitrate of mercury, at all the windows. The poison, it was claimed, coming in contact with the skin of a human being, would cause blood poisoning. The raising of the windows was expected to explode the tubes and scatter the poison into the faces of the intruders. The facts came to the attention of the Fire Marshal, and he ordered the doctor to remove his deadly tubes. The marshal explained that he would not allow the lives of his men to be imperiled in order that a house might be protected from burglars and sneak thieves. He thought that section 1,281 of the Municipal Code, relating to the storing or keeping of any explosive in a building in the city, would cover the case.

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ENGINEERING INVENTIONS.

A steam boiler has been patented by Mr. Elias B. Birge, of St. Paul, Minn. This invention relates to upright steam boilers designed more especially for fire engines, and provides for a novel construction, combination, and arrangement of parts, to effect a rapid generation of steam while utilizing the fuel to the best advantage.

A plunger for oil well pumps has been patented by Mr. Edward P. Landas, of Titusville, Pa. A central tube has annular recesses, with a packing placed around the tube and held in place at the bottom by a screw cap, a sleeve being adapted to slide on the tube, and a spring pawl pivoted to the sleeve and engaging with the annular recesses in the central tube.

A steam engine has been patented by Mr. Charles Gibbs, of New York City. It has a chambered or hollow piston having valves in its ends, the valve in one end to remain closed and that in the other end to remain open during each stroke of the piston, in such way as to cushion the pistons as they approach the ends of their strokes, the construction being likewise suited for air and gas engines.

A car coupling has been patented by Mr. Bush F. Laird, of Ocean Springs, Miss. Combined with the drawhead and coupling pin is a support having a spring-actuated rest, the rest having its sides grooved, and pivot bolts for securing the support in the drawhead, with other novel features, it not being necessary, with this coupling, for train men to go between the cars to couple or uncouple.

A safety water gauge has been patented by M. William E. Roche, of Peabody, Mass. Combined with the casing and a valve spindle, a valve having two stems is fitted loosely in the casing, one stem seated in the casing and the other in the valve spindle, with other novel features, the parts being so arranged that, should the glass tube break, the valve will close and prevent the escape of steam or water.

A cut-off for steam engines has been patented by Emilio Querol y Delgado, of Brooklyn, N. Y. Combined with the slide valve rod and eccentric rod are a slotted valve-operating lever connected with the rods, a movable fulcrum for the valve lever, and a governor driven by the engine and arranged to move the fulcrum of the valve lever in accordance with the requirements of the engine, whereby the stroke of the slide valve will be regulated by the load carried.

MECHANICAL INVENTIONS.

A manipulating rod for bolts, etc., has been patented by Mr. Joseph A. Coultaus, of Brooklyn, N. Y. The rod is formed of pivotally connected sections, one of which has a shoulder or bearing portion arranged to be thrown against a stop, such as the casing of the bolt, to hold the rod and the device attached thereto in a retracted position.

A foot power has been patented by Mr. David D. Camp, of Stoughton, Wis. Combined with a crank arm attached to a shaft carrying the driving wheel, and a link having a series of apertures, with a swinging arm made of two parts which can be adjusted to each other by a thumb screw, is a treadle pivoted on the swinging arm, with various other novel features, whereby a dead center is avoided, and the device is applicable to a bench or stationary frame.

MISCELLANEOUS INVENTIONS.

A shirt has been patented by Mr. William A. Lawrence, of Newburg, N. Y. This invention covers a novel method of making the garment, by improving the manner of uniting the bosom portions, whereby a neat, quick, and effective lacing or fastening is produced.

A tambourine has been patented by Mr. Henry Hosens, of Brooklyn, N. Y. Combined with the rim, head, jingles, and their pins, is a second rim and spacing tubular washers, whereby many more jingles can be used than is possible with the usual construction.

A harness loop has been patented by Mr. Thomas S. Alexander, of Meriden, Conn. It consists of a separate loop casting, in combination with a separate plate secured at one end directly to the body casting, the invention covering various details and parts designed to furnish an improved article of manufacture.

A casing for spittoons has been patented by Mr. Julius F. Langenberg, of New York city. It has a lid or cover hinged to the top of the casing, and connected by a rod with the hinged front of the casing, to keep the spittoon out of sight when not in use, preventing access thereto by flies, etc., and preventing all smell therefrom in the room in which it is situated.

A combined blackboard and desk has been patented by Mr. George W. Weiss, of Brooklyn, N. Y. The board can be automatically turned upon its axis to present either face, and below the board, within the frame, is a hinged leaf, which is supported and locked when desired for use as a desk or table in an inclined or horizontal position.

A pocket corkscrew has been patented by Mr. Le Roy B. Haff, of Englewood, N. J. This invention relates to a corkscrew wherein the screw is pivoted to a carrier sliding within the handle, so it can be folded and concealed within the handle, and the construction is such as to give compactness and portability when closed, and strength and efficiency when opened.

A metallic printing block for electrotype and stereotype plates has been patented by Mr. John Fahnestock, of Brooklyn, N. Y. The invention consists of clamps fixed on the block, with movable clamps simultaneously actuated by a key applied to a post mounted in the block, whereby the plates may be firmly locked and conveniently released.

A bottle has been patented by Mr. Paren England, of Aspen, Col. It has a bend or swell in its neck on one side, and upon the other an inward projection, with a bulged or englarged chamber beneath it, whereby the expulsive force of gases in the bottle will act upon the cork in a direction in which it has little or no tendency to force the cork out.

A cartridge loader and crimper has been patented by Mr. Benjamin M. Badger, of Summerton, S. C. The machine has a charge guiding and cartridge loading cylinder, with a crimper arranged operatively in line, whereby a shell may be charged complete and crimped before removing it, the result being accomplished by simple devices, without any complications.

A combined coal elevator, screen, and loader has been patented by Mr. Lewis G. Scofield, of Philadelphia, Pa. This invention covers the construction and combination of various parts in a machine by which the coal can be shoveled from the bin or yard into the elevator, raised to the screen, screened, and discharged from the screen into a cart, only one shoveling being necessary.

A type-writing machine has been patented by Messrs. George W. Greene and Lewis P. Smith, of Smithfield, Ind. Combined with an impression cylinder is a rocking inking ribbon support and mechanism, for rocking the ribbon support from the cylinder, with other novel features, the design being to make a type writer with comparatively few parts, and not expensive to manufacture.

An anti-friction hand ironing machine has been patented by Mr. Frank Corbett, of New York City. Combined with the casing and rollers journaled therein are friction wheels pivoted to the sides of the casing and bearing upon the journals of the rollers, in order to lessen the friction and wear of hand ironing machines, that they may be more easily operated and more durable.

A dental plugger has been patented by Mr. Winfield H. Baldwin, of Norwalk, Conn. It is a dental mallet in which is a cylinder, a revolving spindle and a spirally ribbed striker within the cylinder, with a spring arranged to act upon the striker, and a studded thumb plate arranged to engage the spiral rib of the striker, by which the force of the blow can be regulated as desired.

A duplex music box has been patented by Mr. Alfred Junod, of Ste. Croix, Vaud, Switzerland. It has two independent cylinders and two independent combs or groups of combs, one comb or group of combs for each cylinder, so that a melody can be played by one cylinder on one comb, and the accompaniment by the other on the other comb, or each cylinder can play a melody alone.

A water filter has been patented by Mr. Robert L. Darragh, of New York City. This invention covers a novel construction and combination of parts in which a perforated spreader of convex form, with projecting nipples, discharges the water to be filtered near the under surface of the filtering material, there being upper filtering and lower sediment chambers divided by a perforated diaphragm.

A breast pump has been patented by Messrs. Henry Van Altena and Victor C. Vantwoud, of Brooklyn, N. Y. This invention has for its object to provide a convenient connection with the mouth piece and vacuum bulb of the exhaust bulb and its attached flexible tube, and also to provide external means of destroying the vacuum of the pump, thereby gently releasing it from the flesh.

A system of blind nailing has been patented by Mr. David M. Balsar, of Duluth, Minn. In carrying out this invention, the casing, base board, rail, or other woodwork is made in two or more sections, the first section applied being held by nails, screws, or other fastenings driven into portions concealed by parts afterward applied, and which are supported by the parts first secured in place.

An ironing board has been patented by Mr. John G. Breckenridge, of Springfield, Ohio. Combined with a board is a leg pivoted on one end, with a notch in its upper end, and a bar or key pivoted on the board for engagement with the leg to prevent the board from swinging down on the leg, making an ironing board that is strong and simple, and can be compactly folded.

A portable bath tub has been patented by Mr. Samuel D. Freeman, of Fort Thomas, Arizona Ter. It consists of two sacks or pouches made from a light flexible material, impervious to air and water, and connected to form a central water chamber and surrounding air chamber, wherein the sides are intended to be sustained by the action of the water upon the confined air.

A wire hoop has been patented by Mr. Jacob C. Durling, of Marine City, Mich. It is an inexpensive device for locking wire hoops used on barrels, packages, etc., the fastening plate having two or more alternate offset portions, with apertures in their sides, and the central offset and end portions of the fastening plate underlapping the hoop ends and each resting upon the vessel.

A grate has been patented by Mr. Benjamin F. Warren, of Boston, Mass. It has an outer stationary part with beveled seats on its front and rear bars, an inner part having front and rear inclined guiding surfaces, teeth, and cam-bearing arms adapted to be engaged by cams on a supporting shaft, to provide for the rapid discharge of ashes, and the larger clinker, with the least possible waste of fuel, in all kinds of stoves and ranges.

A retouching table for use in photography has been patented by Messrs. Charles L. Dunham, of Rahway, N. J., and George N. Hoffman, of New York City. It is so made that it can be conveniently placed and adjusted for best utilizing the light attainable, and so the operative parts can be folded horizontally out of sight, for use as a parlor table or a working table, while the table may be used in cabinet form as a receptacle for lenses, etc.

A window screen has been patented by Mr. Michael H. Walsh, of Troy, N. Y. It is made in two sections, adapted to enter and slide in parallel independent grooves, thus permitting access to the outside without leaving the space occupied by the screens entirely uncovered, and there are means provided whereby any intervening space between the top of the screen and the bottom of the lower sash, when raised, is protected from the entrance of insects.

A gate has been patented by Elsey B. Russell, of Bardstown, Ky. It is made with springs instead of long weighted levers to balance the gate, and so that, by a slight pull on the handle, the gate will unlatch, and coiled springs will then operate to raise it, ceasing to act when the gate is balanced, or reaches its dead point, the gate being closed by the traveler pulling upon the handle on the opposite side of the gate after passing through.

An adjustable plate holder for photographic cameras has been patented by Mr. Erastus B. Barker, of New York City. Combined with sliding plate-holding bars are endless bands passing around pulleys and connected with the plate-holding bars, to cause the bars to move equally in opposite directions, thus centering the plate in the plate holder, the object being to render a plate holder already patented more convenient and reliable.

An addition pencil has been patented by Mr. Chester R. Thompson, of Elberon, Iowa. The cylinder or case of the pencil is of the usual size, and, besides the usual telescopic lead holder, carries an indicator on which are consecutive numbers, the units and tens of which are made to appear at openings in the case, on pressing the point of the pencil on the paper, in adding and pointing off the figures of a sum, in such way as to represent the progress of the addition.

An apparatus for forming and dividing bombs or shells made of ice cream has been patented by Mr. Simeon Julien, of Nice, France. The invention consists of a receptacle or mould having in its interior a mechanism or device for cutting ice cream into small pieces by the use of an explosive charge, the charge producing a colored light before explosion, and the mould having feet and handles for convenience in setting it on the table and moving it from place to place.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL HAND-BOOK OF PUMP CONSTRUCTION. By Philip R. Bjorling. E. & F. N. Spon: London and New York.

This modest manual is very comprehensive in its scope, while still quite elementary in its descriptions, which are accompanied by numerous well made illustrations. The remarks on designing pumps, on materials of which pumps should be made for different kinds of liquids, and on various classes of pump valves, show an extended practical experience by the author in this line of mechanics.

THE PUMP CATECHISM. By Robert Grimshaw. New York: Practical Publishing Company.

This book is uniform in style with the Steam Engine Catechism of the same author, and is written rather for runners, owners, and makers of pumps than for professional men. It sets out to show how to take down, set up, adjust, and run any of all the principal types and makes of pumps in use.

ELEMENTS OF GEODESY. By J. Howard Gore. New York: John Wiley & Sons.

In the historic sketch which forms the first chapter of this work, the author gives interesting details of many measurements, in different countries, through a period of over three hundred years, for the determination of the length of a degree. Reference is made to some of the best topographical work thus far done in Europe, with a portion of which the writer was himself actively connected, subsequently holding a position in the United States Geological Survey. Subsequent chapters treat of instruments and methods of observation, base measurements, field work of the triangulation, theory of least squares, calculation of the triangulation, and formulæ for the computation of geodetic latitudes, longitudes, and azimuths.

THE NEW YORK AND NEW JERSEY DIRECTORY OF STEAM USERS AND USERS OF MACHINERY. New York: The J. N. Mills Publishing Co.

This book is a business directory covering the States of New York and New Jersey, the contents being arranged by city and town alphabetically, and giving names, business, location, and number of boilers used in each establishment. To any one seeking to furnish supplies or to introduce new inventions in shops of various kinds, it will afford a ready reference handbook.

ENTERTAINMENTS IN CHEMISTRY. By Harry W. Tyler, S.B. Chicago and Boston: Interstate Publishing Co. Pp. 79.

This little work presents typographically a most attractive appearance. It treats in a very lucid way of simple experiments in chemistry, its style being more popular than is usual in this class of book. Its table of contents gives a good idea of the style of treatment adopted. "Some experiments with an invisible gas" (carbon dioxide) begin the book; the gases which form the air; the chemistry of the candle; combustion and explosion; a glass of water; the solution of metals; sulphur; hydrogen; ammonia; a visible gas (chlorine); soap; and the chemistry of yeast, are the remaining subjects, in their order of treatment. We can commend the book as a source of information to all beginners in chemistry, and welcome it as an addition to the literature of experiments in science.

Received.

COCOA AND CHOCOLATE. A short history of their production and use. Walter Baker & Co., Dorchester, Mass.

CANADA: ITS HISTORY, PRODUCTIONS, AND NATURAL RESOURCES. By Hon. John Carling, Minister of Agriculture, Canada. Department of Agriculture of Canada, Ottawa.

AN ELEMENTARY COURSE IN PRACTICAL ZOOLOGY. By Buel P. Colton. Boston: D. C. Heath & Co.

USEFUL HINTS AND INFORMATION FOR STEAM USERS. New York: The J. N. Mills Publishing Company.

A MANUAL OF LITHOLOGY. By Edward H. Williams. New York: John Wiley & Sons.

THEORY OF MAGNETIC MEASUREMENTS. By Francis E. Nipher. New York: D. Van Nostrand.

THE FOREST WATERS THE FARM. By M. Antonin Rousset. Translated by Rev. S. W. Powell. New York: *Forest and Stream* Publishing Co.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The new "Trautwine's Curves" is an exceptionally handsome book. *Engineering News*, July 3, 1886, says it "is probably the most complete and perfect treatise on the single subject of railroad curves that is published in the English language."

For Sale—Ivory button works. Large, well lighted building; 20 H.P. engine; capacity, 200 gross per day; doing splendid business; plenty of cheap labor. Price, only $3,000. Address T. Bergy, Caledonia, Mich.

Wanted—A pushing man, capable of taking charge of a shop for building engines. A fine chance for a skilled mechanic. Address, with references, etc., lock box 17, York, Pa.

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Wanted—Tool agents in shops. Outfit free. E. H. Randall & Co., 154 Lake St., Chicago, Ill.

Wanted—A second-hand Boomer or Bushnell wine or cider press, in good condition. State size, price, and where it can be seen. Address H. B., P. O. box 773, New York city.

Niagara Steam Pump. 20 years before the public. Always first premium. Adapted for all purposes. Norman Hubbard, Manufacturer, Brooklyn, N. Y.

Cotton Belting, Linen Hose, Piston Valve Rod Packing. All kinds of Mfrs. supplies. Greene, Tweed & Co., New York city.

Link Belting and Wheels. Link Belt M. Co., Chicago.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Protection for Watches.
Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any watch. Experimental exhibition and explanation at "Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F. S. Giles. Agt., or Giles Bro. & Co., Chicago, where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Concrete patents for sale. E. L. Ransome, S. F., Cal.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co. 419 East 8th Street, New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1886 Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Hoisting Engines. D. Frisbie & Co., New York city.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Manufacturers' Advertising Bureau. Benj. R. Western, Treas., 8 Broad St., N. Y. Managers of advertising for firms. 20 years' experience.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) J. C. M. asks how kerosene oil can be made a red color. A. Use the extract of alkanet root, sold under the trade name of alkanine, or make your own extract and color with that.

(2) P. V. I. asks (1) what receipt there is for making magic wire solder. A. Magic wire solder is ordinary strip solder. As flux for iron or brass surfaces you may use the following: Dissolve as much zinc chloride as possible in one part of alcohol and then add one ounce glycerine. 2. A receipt for making a liquid glue or cement for mending wooden, glass, or china ware. A. See the article on cements contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(3) H. C. asks (1) what preparation to put in any common ink, especially India ink, so it can be used for a hektograph. A. Mix with glycerine. 2. How to make black hektographic ink? A. Use a strong aqueous solution of soluble aniline black, in the proportion of about 1 to 5 or 7 of water. It must be a saturated solution, rather thick.

(4) A. S. asks: Is there any chemical or bleaching process known, by which dark colored animal hair can be given a bright color, say dark brown to light brown, or dark gray to light gray? A. Yes. Use hydrogen peroxide. See the articles on this subject contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 184 and 339.

(5) G. A. L. asks a formula for making modeling wax. A. Use whi e wax, which is melted and mixed with lard. In working it, the tools and the board or stone are moistened with water, to prevent it adhering; it may be colored to any desirable tint with dry color.

(6) H. W. C. writes: A farmer wishes to know how to construct a cheap and easily handled filter for water. A. Use two stone pots or jars, as shown in the accompanying engraving, the bottom one being a water jar with side hole, if it can be procured; otherwise, if no faucet can be used, the top jar can be removed to enable the water to be dipped out. The top jar must have a hole drilled or broken in the bottom, and a small flowerpot saucer inverted over the hole. Then fill in a layer of sharp clean sand, rather coarse. A layer of finer sand, a layer of pulverized charcoal with dust blown out, then a layer of sand, the whole occupying one-third of the jar.

(7) J. H. F. M. asks: 1. How long could a man live in pure oxygen? A. It is not definitely known how long a man would live in pure oxygen. 2. How long do the pearl divers hold their breath, and would it make any difference if they breathed oxygen instead of air? A. It would probably enable them to bear a longer immersion if they filled their lungs with oxygen before descending. A minute to a minute and a half is a fair period of immersion. 3. Is there any cure for a horse that is subject to colic? A. No general remedy can well be prescribed, as colic may arise from a variety of causes. Castor oil and laudanum are often recommended. 4. What is the pressure of water at the moment of freezing? A. Water in freezing can exert a pressure probably not less than that of 4,000 atmospheres. 5. What would be the effect if it was confined so it could not expand? A. If prevented from expanding, it will not freeze except at very low temperatures.

(8) C. W. S. asks: 1. What is the explosive force per square inch of two cubic feet of hydrogen gas and one cubic foot of oxygen gas, making three cubic feet of the two gases, at atmospheric pressure? A. The theoretical pressure from the perfect and instantaneous explosion of hydrogen and oxygen gases without compression is probably nearly 200 pounds per square inch. A much less pressure is obtained in practice. 2. How long will it take a cheap battery of one cell such as described in SCIENTIFIC AMERICAN of April 11, 1885, to decompose one pint of water, porous cup being two inches diameter inside and six inches high? How long with six cells? A. The decomposition of water by one or six cells, as described, is a very slow process. It will possibly require several weeks to decompose a pint. 3. Is there any substance that magnetism cannot act through? I notice watches advertised as anti-magnetic. A. There is no substance that will insulate a magnet. Watches are protec ed by iron cases or iron lining within the case, the substance thereof arranged to have possible magnetism of different parts balance each other. 4. Which is best for the battery—wrought or cast iron turnings? A. Cast iron borings or turnings.

(9) H. O. G. asks: 1. If a thermo-electric pile can be used to a good advantage as a thermometer in connection with a sensitive galvanometer? If so, how? If not, can you explain how the temperature outside may be indicated inside the house without too great expense? A. The thermo-electric pile indicates, in connection with a galvanometer, differences in the temperature of its two faces only. We do not see how it could be used as suggested. There is a company in this city who put up thermometers designed to indicate the temperature of distant places. 2. Will the expansion and contraction of zinc rods be greater if they are amalgamated than if not? And in what proportion can zinc and mercury be melted together to form a solid? A. We have no knowledge of the relative expansion of amalgamated or unamalgamated zinc. The former is extremely brittle, and would probably expand the most. A great deal of mercury is taken up before liquefaction by zinc, but it continually tends to separate from it.

(10) M. J. H. asks: A porter here takes care of some lamps—filling, lighting, etc. He has been found fault with for failure, so he says, to wipe the bowl proper of the lamp after it has been filled. This, however, he has done regularly, he says, and claims that the oil on the bowl is not due to carelessness, as charged, but to condensation of the vapor of the oil after the lamp has stood some time, or been in use. Is he correct as to the cause of the oil on the bowl? A. Kerosene oil "creeps," as it is called, by capillary action, and will often cover the outside of a lamp with oil, even though the same is taken good care of. Capillarity, and not condensation, is the force involved. Your party is probably taking every care of the lamps. Try the effect of wiping one off yourself. Perhaps he fills them too full, or neglects to turn the wicks below the brass when the lamp is not burning.

(11) A. W. R. asks: What are the poorest conductors of heat? A. Glass and porcelain are very poor conductors. All porous bodies are the same.

(12) C. F. J. writes: I would like to know how to make a rubber paste for patching the bellows of a camera which has cracked at the corners, so that there are several small holes through which light gets in and fogs the negatives during exposure. A. Try some of the liquid glues. These give good results. Or try a solution of gutta percha in bisulphide of carbon.

(13) E. J. R. asks: 1. How many pounds of insula ed wire will be necessary for field magnets and armature in dynamo described in SUPPLEMENT, No. 161? Also, if it should be of any particular brand. A. About 5½ pounds in field and ½ pound in armature. 2. How can tempered horseshoe shaped steel, about 3 inches across, be permanently magnetized on a large dynamo? Poles are a greater distance apart, that is, I cannot put poles of small horseshoe on two different poles of dynamo. A. You might run two bars of iron from the two poles of the dynamo magnet to the poles of your smaller one. This would give you some effect.

(14) S. C. H. asks; Must the secondary coil in a telephone transmitter be wound to about the same number of ohms resistance as the bobbin over the bar magnet in the receiving instrument, to get the best results, and also do they require to be wound to a higher resistance for long distance telephoning? A. The secondary coil in the induction coil of a telephone transmitter is wound to 80 ohms in the Bell Company's instruments and to 250 ohms in the Edison instruments. The receiver coil has about 80 ohms resistance. They are wound the same for all ordinary distances. They need not be wound to the same resistance.

(15) W. F. T. asks: Does a horse hair turn to a worm in water? If so, why does it do it? A. It does not do it.

(16) M. asks: Will you be kind enough to answer in your paper, how many and what are the primary colors? A. Seven is usually accepted as the number—violet, indigo, blue, green, yellow, orange, and red—but several scientists have proposed three as being really the primary colors.

(17) H. V. asks: Will you please oblige me by answering a few questions in SCIENTIFIC AMERICAN? 1. Will naphtha gas explode by an electric spark? A. Naphtha gas mixed with air forms a mixture that will explode by the electric spark. Naphtha gas alone will not. 2. What heat will naphtha evapora e at? A. At various temperatures, according to its manufacture, from 100° Fah. upward. 3. What heat is naphtha dangerous at? A. It is dangerous at all heats if near a fire of any kind.

(18) J. G. asks if there is an instrument that measures, accurately and instantaneously, distance, that is within the range of vision, from point to point on water or on shore, or from shore to a point at sea, or *vice versa*. A. Various instruments called stadia have been invented for effecting this purpose. An object of approximately known size must be present at the point whose distance is to be determined, to serve as a base line.

(19) J. P. H. S. asks how to color billiard balls. A. For red, macerate cochineal in vinegar, and boil the balls in the liquid for a few minutes; for blue, immerse for a short time in a dilute solution of indigo carmine; for yellow, immerse for a few minutes in water containing a little s annous chloride (protochloride of tin), afterward in a hot strained decoction of fustic; for violet, dye red first, then immerse for an instant in solution of indigo carmine; for green, dye first yellow, and afterward dip into solution of indigo carmine. Or use the aniline colors in solution without mordants.

(20) A. L. B. asks: What can be applied to rubber stuffs, like rubber bands, to keep them from rotting? A. We know of nothing except to keep them clean; oil or grease is very destructive to rubber. 2. What is the best way to prevent a flute being injured by the weather? A. A flute must be carefully kept, and is liable to suffer from any abrupt changes in the weather, and so should be preserved in chamois. We know of no better advice to give you.

(21) H. I.—Our imports of merchandise for the calendar year 1886 were $663,417,210. You ask how much the "working class would earn on these goods if made here, and not imported"? A considerable portion of the imports are of natural products, grown, not made, and that could not be grown here under favorable conditions. Probably one-half, however, represents manufactured products that really come into competition with those made by our own mechanics. How much more our workers would make by producing all such goods here, is a question that lies at the bottom of all tariff discussion, and which, consequently, we cannot be expected to enter upon in this place. If it were possible, however, for us to make all these goods ourselves, and thus shut out foreign manufacturers from our markets, is it likely that we could continue selling our products in foreign markets, as at present? Although our imports for 1886 were so large, our exports for the same period were still greater, reaching $713,289,666.

(22) C. J. H. R. asks: Can you tell me where to find a receipt for the ink used to re-ink type writer ribbons? A. Take of aniline, either black, blue, or violet, ½ ounce, alcohol 15 ounces, concentrated glycerine 15 ounces; dissolve the aniline in the alcohol and add the glycerine.

(23) A. C. S. A. asks: How far does Maud S. step when trotting her best? A. She strides about 19 feet.

(24) C. H. K. asks the process of stuffing a deer's head. A. We can send you Batty's "Practical Taxidermy and Home Decoration" for $1.50, which will give you full information on this subject. It would require too much room for a place in this column.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

February 1, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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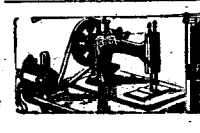
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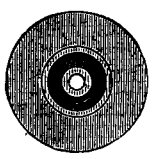

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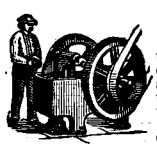

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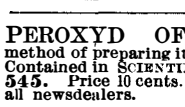

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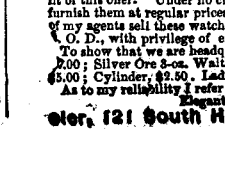

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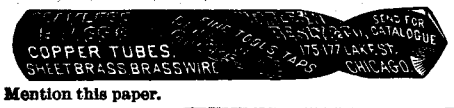

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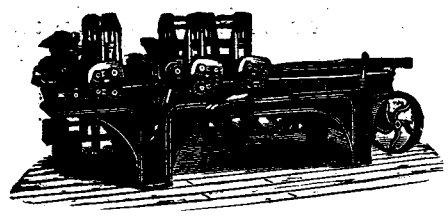

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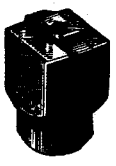

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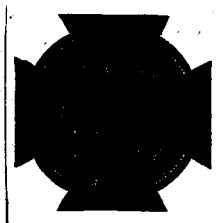

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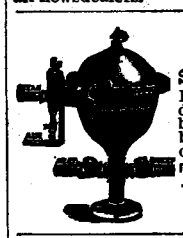

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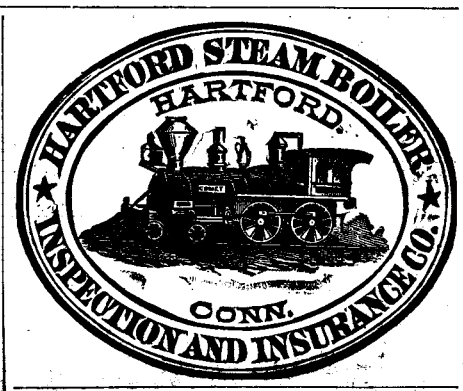

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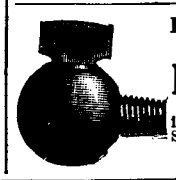

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